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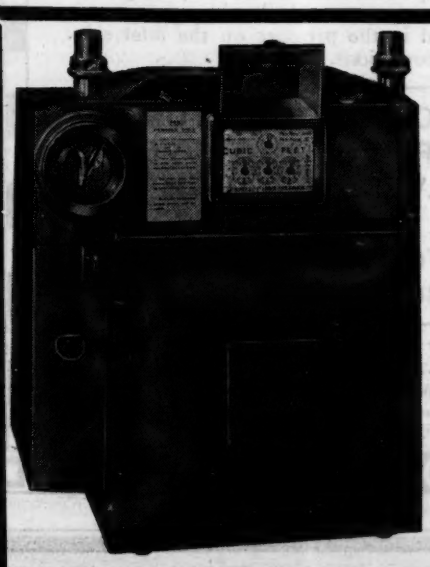

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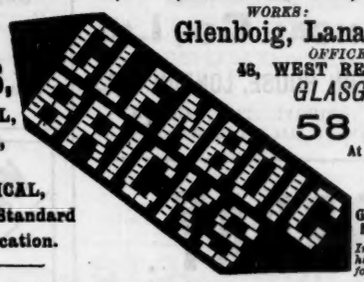

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EDITORIAL NOTES.

Distributing Economically Produced Therms.

THE engineer responsible for the distribution of gaseous heat units stands between the necessities of producing those heat units in the most economical form, and of placing them in adequate quantity in the possession of the consumer who wants the maximum possible potential heat value for the money he expends. These two conditions can be met by reducing within reasonable limits the calorific value of the gas produced. In other words, more heat units can be put in serviceable form into the distribution mains per ton of material handled by making a gas of lower calorific value than by producing a high-grade gas—the lowness of the calorific value being governed by considerations affecting utilization. The powers of the Gas Regulation Act, and the requests and developments of the times, have shifted the gas industry from its state of normal evolution under restriction into what is truly a transitional period of no mean order. "The transitional period will be difficult; but "that is a condition common to all transitional periods." So philosophically writes Mr. Walter Hole, of Leeds, whose work as a distribution practitioner, and whose contributions to the literature of the subject, are widely known throughout the gas engineering world. Mr. Hole, following up the special articles of last week by Prof. Cobb and members of his staff at the Leeds University on the production of B.Th.U., deals this week with the transmission of the units from the works to the consumers' meters.

The difficulties and problems are many that have to be faced in the work of distributing lower grade gas. Some gas men have failed to grasp all the Gas Regulation Act embodies and portends, and the possibilities it has started to fashion into actualities. They think that, so far as distribution is concerned, the differences that some men foresee between the transmission of heat units and that of volume are merely chimerical. It would be so were it not that the industry is in a transitional condition, and has been set the task of supplying heat units as cheaply as possible. Everything favours the transition, and out of the transition will come progress. The differences that will develop as between old-time distribution and new will be due to the changed ratio as between volume and heat units, and the new order of things that this will bring about in the constitution of the gas supplied, and the effects that the new constitution will have upon the distribution system itself, unless preventative measures against destructive tendency are introduced. Experience has been gained in these directions during and since the war. Mr. Hole shows in the article that he has taken measure of the difficulties that there will be; but he is not alarmed by them, because, as engineer and constant student of his subject, he sees that all the problems that confront are capable of solution—at a price, perhaps, but with good compensation. Any distribution obstructions that there may be in the path of progress must be cleared away. When the producing engineer has determined how far he can descend in the economical generation of gaseous heat units which will serve the users of those heat units whatever the purpose, then the distribution engineer has to take and deal with what is placed in his charge. To adopt a *non possumus* attitude would be unworthy of his position as an engineer.

What changes in condition are likely to be brought about under the reign of liberty in declaring calorific values per cubic foot, and in selling gas by the therm, no matter the volume of the gas? Mr. Hole points them out. A larger volume of gas will have to be carried, as one of the penalties or consequences of more economical heat-unit production. This will be the first new distribution condition which will have to be faced. Then, generally speaking, housing schemes have been allocated sites on the outskirts of cities and towns where the existing distribution conditions are in cases quite inadequate to need, let alone taking on new loads. Further, as there is diminution in the calorific value of the gas, and it is altered constitutionally, its specific gravity will become greater; and as the latter is raised, it will cause material shrinkage in the volume of gas transmitted, other conditions being equal. Mr. Hole gives an example which arrests attention. If the specific gravity of gas is raised from 0·4 to 0·6, the delivery through the mains will, in like circumstances, be reduced by 18 p.ct. This is a serious diminution. Then the lower grade gas is largely deprived of its light oils; and this is partly responsible for the increase of internal corrosion in the distribution system, which reduces capacity and intensifies friction—two things which are anything but wanted with a larger volume of gas to be transmitted. The station governors and consumers' meters have also been affected by the same cause. Then the Gas Regulation Act enforces a considerable advance in permissible minimum pressures. But, standing alone, there is nothing much in this point; seeing that 2 in. minimum pressure is what has been given for some time by (as Mr. Hole puts it) all alert gas undertakings. But not all responsible gas engineers are alert. We have recently heard of several districts where a low-pressure gas-burner cannot be efficiently used, because of the lack of pressure and volume with lower calorific power gas; and yet the same burner gives a good account of itself in other areas, with gas of about equal quality. The lower grade gas involves distribution at higher pressures in order to satisfy the demands of modern gas apparatus. There are some tradition-bound gas engineers who shrink at this. They still fear that their leakage account will increase if they raise their pressures. They must read what Mr. Hole says on the matter, and must shake off the retarding influence of obsolete beliefs. Otherwise, they will be left behind in the progressive march. They cannot have more economical heat-unit manufacture without increase in pressure. The two things are inseparable. In this connection Mr. Hole warns the Board of Trade. They have power to prescribe different minimum pressures in different districts in the same area of supply. Seeing that districts in the same supply area are not, as a rule, isolated from each other, different minimum pressures may give rise to considerable trouble.

The difficulties and problems produced by the changes in condition may appear, taken together, to be somewhat formidable; but they visibly recede when considered in detail, with Mr. Hole's assistance. First of all consideration has to be given to the compensations that changes in the use of gas have produced; and this is a subject upon which we had quite recently a most illuminating paper from Mr. Stephen Lacey, the Chief Distributing Engineer of the Gas Light and Coke Company [see "JOURNAL" for Dec. 22]. During the last decades, the earning capacity of the existing gas distribution systems has increased enormously, through the growth of the domestic and industrial day use of gas. Indeed, in many districts the greater part of the distribution systems (excepting perhaps in residential areas during the Sunday cooking load) are still capable of supplying more day gas before the load is equal to the evening one, during which period of the day, in considering the ratio of volume to lower calorific power gas, the incandescent burner is a factor to which in these times of change the industry has a fresh cause for acknowledging indebtedness. But Mr. Hole points out that the time will come when the compensations will be available no longer, owing to the reserves in the

distribution system being overtaken. Even so, the engineer has to be thankful that the changes in use have produced so much advantage in the distribution system; and this is a consideration which should be kept well in mind, and for which credit should be given, when calculating the modern costs of making distribution improvements, which is a penalty of success and progress which has to be faced, and will have to be cheerfully borne. Systematic improvement will have to go on—from compulsion, distinct from expediency—inasmuch as the statutory minimum permissible pressure is now to be 2 inches. The first step in improvement is the elimination of the smaller sizes of mains and services. "B.Th.U. are going to compel," says Mr. Hole, "larger "ideas in the way of mains." No mains in future, in his opinion, should be laid of less than 4 in. diameter, and services should be not less than 1 in. The difference in labour costs in laying such mains is almost negligible; and the larger pipes, in addition to their greater carrying capacity, will give increased structural strength, which will be beneficial in these days of changed forms of traffic. Boosting by means of girdle mains round cities and towns for the reinforcing and maintenance of pressure is a system that will grow; and this again is a cheaper plan than recasting the distribution system. Boosting confers flexibility and control in a way that cannot be obtained by other means.

The increased corrosion of mains due to the changed constitution of gas is a matter of supreme importance; but it comes into a different category. The corrosion caused by cyanogen compounds (mainly hydrocyanic acid) is the most difficult problem. The hydrocyanic acid should if possible be eliminated to the last degree; but, unfortunately, there is no practicable method in existence at the present time that can be adopted by undertakings of all sizes. Mr. Taplay, however, told the Institution of Gas Engineers last June that experiments are being made in this direction to ascertain whether a process cannot be evolved which could be applied universally. Success would be highly important. We quite agree with Mr. Hole's submission that the installation of a cyanogen plant should not to-day be looked at from too narrow a point of view. It is not merely a question of direct profit; but the money-saving in preventing the deterioration of the distributing plant should be taken into the account. The same thing applies to the addition to the gas of a sufficient quantity of oil vapour or fog to lubricate the mains, services, governors, and meters. This, again, is a preservative process that is profitable; and it also helps to reduce the labour occasioned by naphthalene deposits. Regarding consumers' meters, Mr. Hole, towards the end of his article, speaks of these; and he hopes to see improvements in two directions—in the provision of a meter which will pass 60 c.ft. an hour, and not occupy more space than a 5-light one, and in the ability to be able to read the meter index in terms of therms instead of cubic feet. Here he has set meter makers two problems which we are much afraid it will take some time to solve. But solvable they should be. He also speaks favourably of the enlargement of the business of gas undertakings by the separate supply of industrial gas which could be distributed in an industrial area at high pressure, and be governed on the consumers' premises.

It is seen that the trend of development in gas supply will bring difficulties in distribution, varying in different areas according to the current conditions of the canalization. They are foreseen; and the means of conquest other than in relation to hydrocyanic acid are known, and are fortunately within reach. There is nothing in them that must be allowed to stop the progress of economy in heat-unit production and utilization. Economical heat-unit production is a continuous and growing need.

High-Pressure Distribution of Heat Units.

THE gas industry has often suffered the ignominy of the accusation of being unscientific; and it has not been blameless of this. But the ground of reproach is passing. At its two extreme ends—manufacturing and utilization—science applied to practice is showing its results. But in the distribution of gas, the taunt is still levelled against the industry. Perhaps there would be less ground for this if the distribution systems of our cities and towns were not to such a large extent among the oldest inhabitants of the subsoil, away out of sight, and so somewhat difficult (without considerable labour and expense) of approach. But in distribution, too, the industry is to-day getting more scientific in its practices; and we are moving to those times when the modern highly skilled engineer will not laugh at the *penchant* of some gas engineers for low pressures and large pipes. The view is gradually changing to the one that high pressure confers greater elasticity in gas distribution, helps to preserve an equilibrium between local pressure and demand, and has a good effect on capital costs, less the cost of compression. The days of the supremacy of rule-of-thumb are passing in distribution practice, and the effect of this will be seen in the lowering of costs in relation to work done in transmission.

The second special article this week deals specifically with high-pressure distribution of B.Th.U. It is a contribution by Mr. B. R. Parkinson, who is well known to gas engineers for his work in conjunction with Mr. J. G. Taplay, the Chemist to the Life of Gas-Meters Research Committee, and whose contribution on unaccounted-for gas to the 1918 autumn meeting of the Institution of Gas Engineers is remembered for its solid technical work, presented in a manner which riveted the interest of the members, and elicited well-merited encomiums. Mr. Parkinson's contribution to our pages this week bears the same characteristics. It embodies both technical and persuasive value, and something that reads almost like romance; for with his technical knowledge moving him, our contributor allows his thoughts and pen to wander into the realms of what might have been if the gas industry were starting its career to-day with the knowledge of the value of compression in storage and transmission. It is all refreshing—this picturesque treatment of a highly technical subject. The practice has been to store and distribute gas with its bulk at atmospheric pressure or practically so; and "coal gas jogs along in the "same old atmospheric way as though it had a right to "stretch itself and take up as much room as the air we "breath." Sarcasm often asserts itself as a good tonic, and inspires to something better. Perhaps where it most applies it will do so in this case. But as to the picture of what might have been had the gas industry been starting to-day. Distribution might have been attacked in an altogether different way. The knowledge of to-day as to compression would have been taken, and upon it the industry would have built, and high pressures would have been adopted to save capital expenditure. Gas would probably have been stored in cylinders at the works, in the trunk main, and in other cylinders along the main, at (say) 300 lbs. pressure. From the trunk main, the gas would have been governed-down to 100 lbs. pressure into subsidiary feeders, and then again to 5 lbs. pressure into the district mains. The only holder would have been a relief one at the works. Storage and distribution would have been combined. There the flight of imagination ends. We know comparatively little about compression costs; and as Mr. Parkinson draws himself back into the realm of practicability, he finds that storage on a large scale at atmospheric pressure remains more economical than the costly metal-absorbing cylinders which would be required for storage at the 300 lbs. pressure that he assumed.

Thus, on practical ground again, Mr. Parkinson cuts-out high-pressure storage on a large scale, and then confines attention to high pressure as an economic factor in capital outlay on mains and in the volume of gas transmitted. Higher pressures are the means by which excessive capital outlay in the changes that are coming over the gas industry will be avoided, with compression costs as a charge against the saving in capital expenditure. But we will not go over the ground covered by Mr. Parkinson. Every word of it will be read. The influences of pressure upon diameters of mains and volumes of gas are dealt with in an interesting manner to those who already know of these things, and instructively to those who do not. There is much to be learnt in the relatively short length of this article; there is much that will awaken interest in the economy and service to the industry of high-pressure working as an aid to development. In this development compression and high-pressure transmission are going to play an important part.

The Pressure Inquiry.

THE attempt of the railway companies to get the Board of Trade to override the Gas Regulation Act and the decisions of Parliament was referred to last week [p. 85], and the proceedings regarding the inquiry into the matter before the Director of Gas Administration (Mr. H. C. Honey), with whom sat one of the Gas Referees (Mr. W. J. Atkinson Butterfield), were reported on later pages. This apparently is a final struggle by the railway companies in respect of the

pressure proposals which were rejected by Parliament, and refused recognition in the Bill, throughout its progress last session. If Parliament had intended that the Board of Trade should accept as a general principle the singular plan of the railway companies, that the calorific power multiplied by minimum tenths of an inch pressure should realize the product of 10,000, they would unquestionably have incorporated it in the Act. That they did not do so shows beyond any shadow of doubt that they intended that variations of prescribed pressure should only be made in special cases, and this is emphasized by the fact that they did not put upon the 2 in. minimum permissible pressure a condition as to calorific power. They only legislated on general lines; and put the minimum permissible pressure at 5-10ths above modern legislative pressure for 500 B.Th.U. gas, which give a margin that would (on the lines of the 1-10th increase of pressure for every drop of 25 B.Th.U., as proposed by the railway companies) allow gas to be carried below 400 B.Th.U. This was a very strong point in the evidence that Mr. W. Doig Gibb gave on behalf of the Gas Light and Coke Company; and therefore on behalf of the gas industry. And Mr. Doig Gibb, through his official capacity during the war, knows how well a 15-10ths pressure answered all requirements in Government and other factories with gas as low as 450 B.Th.U. One cannot discard experience in favour of theory in legislation without getting into all sorts of muddles, and without inflicting injustice. The evidence of Mr. Doig Gibb proved conclusively that the railway companies were trying to inflict onerous and expense promoting conditions on gas suppliers and all the rest of the consumers, to satisfy something that is clearly nothing more than a fad.

If the railway companies' pipes, which were at one time sufficient to carry the larger volume of gas required for flat-flame burners, are not sufficient for the smaller volume of gas required for incandescent lighting, then it is high time that the pipes were overhauled by them. Their shortage of capacity, however, should not be made a reason for the imposing of additional burdens upon gas undertakings and the general body of consumers, who have given the railway companies no mandate in this connection. It must not be forgotten that 2 in. is the minimum permissible pressure, and that this applies to all hours in the twenty-four. This is a safeguard for the railway companies, who to-day, in the majority of cases, burn gas that is under 500 B.Th.U., with a minimum prescribed pressure of 15-10ths and, in not a few cases, much lower. It is observed that Mr. W. R. Herring, who supported the railway companies in their unamiable proposal to impose the greater pressure minima upon gas undertakings, stated that he does not agree that 500 B.Th.U. gas is as good as 600 B.Th.U.; but it is only fair to point out that he qualified this with the remark that "provided the consumer could get delivered a gas to pro-"duce the same result, it did not matter—always assuming, "of course, he paid no more for it." Under the heat-unit system, he will not pay more for it. But we should like to know just what Mr. Herring means when he declares that he does not agree that a 500 B.Th.U. gas is as good as a 600 B.Th.U. gas. Does he mean from the point of view of efficiency? If so, how is it modern scientific investigation assures us that it is impossible to get the same intimate aëration with a gas of 600 B.Th.U. as with a gas of 500 B.Th.U.; that appliances to burn gas of the former quality per cubic foot require more structural refinement than to burn the latter; and that the former needs more constant care on the part of the consumer in adjustment than the latter. It was a strong case that the Gas Light and Coke Company put before the Board for no departure being made from the terms of the Gas Regulation Act; and the railway companies' case was not strengthened when Mr. Honoratus Lloyd, K.C., their Counsel, said he agreed that, as regards the 20-10ths, there was not much in it as between 500 and 400 B.Th.U. gas. This being so, their case fails for an increase of minimum pressure between these two points; but when a gas undertaking proposes to declare anything below 400 B.Th.U., then would be the time—not now—to make application for a decision of the Board on the question of a suitable pressure.

Capital Expenditure and Elasticity of Production.

THE Birmingham Corporation have before them a large programme of costly schemes, which, in the aggregate, need several millions of money. The Government have appealed—not to Birmingham alone, but to all local authorities—for economy in expenditure upon new schemes that can be postponed. But, according to reports from Birmingham, there is another factor which has now thrust itself into the situation, and which enforces economical expenditure. It is that even the great Midland city cannot obtain loans at a reasonable rate of interest with which to finance new schemes. The failure of 6 p.ct. municipal loans for housing schemes is a proof of this. There are several reasons for this condition of things. We refer to some of these in the first paragraph of "Electricity Supply Memoranda" this week. But time was when local authorities had no difficulty in raising money at a lower rate of interest than industrial enterprises. This was due to the security offered by the rates. But this appears in more recent times to have lost some of its weight with, and its attraction to, investors. Why is this? With rates what they are to-day, and with local governing bodies getting more leavened with an irresponsible element who attempt to legislate more for one-class benefits than for the general good, there is a depression in confidence in municipal administration. With this depression in confidence, investors look round; and they see employment for their money in industrial concerns paying higher interest and dividends than municipal loans, and directed by men of good repute. Very naturally they place their money in these industries. Another incentive is that, with income-tax what it is, and with costs of everything what they are, investors want, subject to reasonable security for their money, the highest return they can get. It comes to this, that local authorities (even with the security of the rates behind them) will now have to compete for money on terms that bear a nearer approach to those offered by industrial concerns; and the sooner, too, they set about the task of strengthening confidence in their administration by a reduction of the rates, and exercise restraint in the carrying-out of schemes that are not currently imperatively necessary, the better it will be for them.

Electricity supply is largely in the hands of municipal authorities; and electricity supply in many places is feeling the pinch of the present money-raising difficulties. The Birmingham undertaking has large plant extensions overdue, and many applications for new connections have been registered, but cannot be met. Naturally, the Electricity Committee want to push on with the extension work; but the Finance Committee and the Council are obdurate, and have told the Committee they must wait. Of course, where money is being spent on electrical plant to-day, the cost of production will not be diminished owing to the heaviness of the capital charges involved. The plant may be more efficient; it may show 15 or 16 p.ct. thermal efficiency. A super-power station may reach a 20 p.ct. thermal efficiency. But the capital charges will swamp all the improvement, and leave a balance to the bad on the over-all cost of production compared with the older, and perhaps less efficient, plant, the capital charges on which are so much less.

Gas stands in better case. The industry is passing to a heat unit basis of business. Of late years the British thermal units produced in the form of gas have gone up per ton of coal handled, and per retort used. Added to this, the industry has water-gas and complete gasification plants. Plants cost more money than formerly. Nevertheless, all this progress in thermal efficiency is working well in minimizing the capital charges per unit of output on the thermal basis. All possible elasticity should be introduced into gas manufacture. It is a commercial advantage to keep capital costs per unit of producing capacity at as low a point as is practicable; and so it is to have plant which will enable the gas engineer to meet rapid upward changes in demand such as were experienced by gas undertakings during the cold December days. The electricity industry talk much of a heating load. They cannot secure a heating load on terms equal to those offered by the gas industry; and with the new level of capital charges and renewal costs, their outlook in this respect is not rosy. Moreover, if they obtained any considerable heating load, the cost of stand-by plant would be so enormous as to be overwhelming. There were cold days in the middle of December, when some gas undertakings were sending out in the twenty-four hours 50 p.ct. more gas than they were during some of the milder days two or three weeks before. Heating loads which make such a difference in short-period demand would mean for electricity (if its cost was not prohibitive for the purpose of general heating) a large amount of capital that would be idle the greater part of the year. The consumers all round would have to bear these charges. Many gas engineers are

now planning to incorporate in their gas-producing plants as much elasticity as possible in relation to capital expenditure and speed of output. In doing this, it must not be forgotten that the ability to meet all demands for gas, however rapidly they arise, may be more important for the time being than the making of secondary products, in view of the commercial value of gas, and the necessity above all else of the supply being equal to any demand.

The "Caloriscope."

There will be regret over the announcement that Mr. E. V. Evans, of the South Metropolitan Gas Company, makes in our "Correspondence" columns this week. After seeing the "Caloriscope" at the last meeting of the Southern District Association, and hearing the description of its construction and operation from Mr. Evans, there was hope that the technical staff of the Company had secured something that would for calorific power replace the jet photometer for illuminating power in respect of all kinds of gas. Further investigation has, however, proved that the new instrument can only be recommended for straight coal gas. But this is something to the good. Having got so far, it is to be hoped that the South Metropolitan technical staff will try to surmount the peak of the industry's requirement in this regard.

Why Not an Engineers' Club?

Under this heading, there has been in the electrical journals much discussion of a favourable nature. Mr. L. Trewby, the General Manager of the North Middlesex Gas Company, has joined in it with a supporting letter in the "Electrical Times." He has long been of the opinion that it would be a great asset if engineers had a club where they could meet socially as well as technically; and so he is prepared to support the proposal in every way possible. But he holds that the club, to be any good, must embrace all engineers, and not limited to certain classes; and therefore he hopes that gas engineers will be brought in as much as possible. He also advocates that the Committee should, right from the initial stages, be representative of all branches of engineering; and he has confidence that a large number of the gas engineers in and about London would be prepared to join a club of this catholic description. A communication on the subject appears elsewhere to-day, p. 172.

Local Bill Promotions and the Ratepayers.

The Committee appointed at the time of the economy debate in the House of Commons to consider the procedure governing Bills involving charges (actual or potential) upon the rates, do not appear, according to their report, to have discovered anything that will be particularly effective in preventing squandermania, or in protecting tax or rate payers against speculative ventures on the part of local bodies. In regard to Private Bills promoted by local authorities, the Committee find that very substantial protection is given by the Borough Funds Act and kindred enactments, as well as by the Standing Orders of both Houses; and they say that the ratepayers, owing to their own apathy, do not benefit by these safeguards as they should do. There may be a considerable amount of truth in this; but the Committee do not appear to have investigated the cause for the apathy. If they had done so, perhaps they would have discovered something really useful that would have supplanted apathy by interest.

To Enliven Interest.

However, the Committee consider that perhaps ratepayers may be assisted to a livelier appreciation of the position if the notice of a Bill prior to the statutory meeting under the Borough Funds Act contained a statement showing the financial effect of the passing of the Act. What is meant by the financial effect? We have known many cases of electric supply undertakings which, when they were only schemes on paper, had predicted for them a "financial effect" that raised visions of profits for the relief of the rates, but which undertakings have since occasioned large charges on the rates. If the Committee had recommended that all local authority trading concerns must, after the lapse of three to five years from their start, or those in existence at once, be made, by the revision of charges, to meet all their financial obligations, they would have been proposing something that would have been distinctly practical. Another of the proposals of the Committee is that the notice of the Bill must include an estimate of the charges both capital and annual which would be laid upon the ratepayers, as well as the cost of promoting the Bill. Experience of such estimates is that they are among the most unreliable of efforts. There is always subsequently, when actuality has not squared with prediction, the ready excuse that things have not worked out according to expectations. It will be a good thing if the recommendation be adopted which would improve the position of ratepayers in opposing Bills, and which opposition, if successful, would result in their receiving their taxed costs. But here again a small body of ratepayers are not going to run the risk of incurring heavy liability. To obviate this would mean in every city and town the organization of the ratepayers, and the organization would require financial backing.

When Coal Decontrol Comes.

Up to Dec. 18, the miners kept up their new record in respect of output. It was expected that during Christmas time, there would be a set-back; and so there was. For the week ending Dec. 18, the production was 5,307,000 tons; for the week ending Dec. 25, it was 4,541,600 tons; and for the week ending Jan. 1 3,263,100 tons. But now it is reported there is a glut of coal in England, Wales, and Scotland. The law of supply and demand is out of gear at the present time, and so is not operating to reduce the price of coal. The price is being artificially upheld by control and prohibitive production costs. Competition is robustly at work in the markets abroad; and this country is on the losing side in this respect. At home, industry (particularly steel production) requires less coal. The situation is complicated; and the loss on inland coal, we should not be surprised to learn, is not now being balanced, or barely so, by profits on export coal. The coal owners and the miners do not like the position. They both see bad times ahead. So do the Government. They have a plan for the decontrol of the industry on or before March 31, and have been discussing the matter with the owners and miners. The latter, however, do not wish to see decontrol until the completion of the negotiations for the new post-war wage standard, final determination of which has not yet been made by the Joint Committee who have the matter in hand under the terms of the strike settlement. However, when decontrol comes, unless the cost of production is reduced, one can entertain a fair amount of certainty that the price of coal will be advanced—the lowered demand and the higher output notwithstanding.

Markets for Coke.

The Central Executive Board of the National Gas Council, as the minutes of their last meeting show, dealt with several matters—among them coal, wagon hire, proceedings under the Gas Regulation Act, railway rates, position of the gas industry under the Electricity Supply Bill (No. 2), standard sizes of meters, and other subjects, included in which is a resolution agreeing that the Council should co-operate with the London Coke Committee with the view to finding improved local markets for coke. This is a matter that will brook no delay. The prices of secondary products are showing a downward tendency. Of course, it was not expected that prices would continue for ever at the level to which they had ascended—especially coke—through artificial or exceptional conditions. The export prices for coke have been tumbling down; and home values show an inclination, and indeed have begun, to turn. With foreign markets for coal being so industriously fed by America, the demands from abroad upon this country's coal have suffered a serious drop; and it is stated that some collieries, especially in Scotland, have available supplies for which they have no demand—owing to the conditions abroad and in Ireland. This makes it all the worse for coke; and so it must be expected that prices will rather recede than otherwise. We do not want the pre-war history of large accumulations to repeat itself; and so nothing must be left undone which can be done to stimulate home demand. The value of coke in steam-raising has had such excellent demonstration, that this is one of the lines along which there will be chief initial operation.

Presentation to Mr. C. Valon Bennett.—On the evening of the 8th inst., the annual staff supper of the Rochester, Chatham, and Gillingham Gas Company was held at the Gordon Hotel, Rochester. On this occasion, a presentation of a canteen of cutlery was made to Mr. C. Valon Bennett (the Engineer, General Manager, and Secretary), by the Chairman of the Company (Alderman E. W. Willis, J.P.), on behalf of the staff, as a mark of esteem. Mr. Bennett presided; and a most enjoyable evening was spent with a display of staff talent.

PERSONAL.

A note by the Executive Chairman (Mr. F. W. Goodenough), in the January "Bulletin" of the British Commercial Gas Association, makes the interesting announcement that, to relieve Mr. W. M. MASON as far as possible of office management and routine, and to enable him to devote more of his time, energies, and personal gifts to the work of developing the Association's power for service to the industry as a whole, and to the subscribing undertakings individually and through the various District Committees, the General Committee at their last meeting approved a recommendation from the Executive to appoint Mr. Mason to the position of Manager of the Association, and to promote the Assistant Secretary, Mr. J. C. WALKER, to the position of Secretary. With the members, we are glad to know that Mr. Mason has now quite recovered his health, and will, by reason of the new arrangement, be able to give the industry in even fuller measure than in former days the benefit of the zeal, energy, and enthusiasm which have created for him a high reputation and a wide popularity among members of the Association throughout the country. Mr. Goodenough adds that Mr. Walker is already well known to many members through his work as Assistant to (and at times deputy for) Mr. Mason; and the Association are fortunate in having an officer with such knowledge and experience of the work to take over the secretarial duties of which the Manager will be relieved.

Mr. E. HONORATUS LLOYD, K.C., has been appointed Recorder of Chester, in succession to his father the late Sir Horatio Lloyd.

Mr. A. E. BUCKLEY, who is Engineer and General Manager of the Malta and Mediterranean Gas Company, Ltd., has been elected a member of the Institution of Mechanical Engineers.

The position of Draughtsman and Engineering Assistant to the Darlington Corporation Gas Department has been filled by the appointment of Mr. ARTHUR PLANT, who is now with Messrs. R. & J. Dempster, Ltd., of Manchester.

The Secretary for Mines has promoted Mr. THOMAS HARRY MOTTRAM, of Doncaster, Inspector of Mines for Yorkshire and the North Midland district, to be Chief Inspector of Mines. Mr. Mottram went to the Doncaster district in 1912, in succession to Inspector Pickering, who lost his life in the Cadeby explosion of that year. Mr. HENRY WALKER is to be Deputy Chief Inspector for Mines.

OBITUARY.

ERNEST WILLIAM DREW.

The funeral took place, at Carshalton Parish Church, on Tuesday of last week, of Mr. Ernest William Drew, F.C.A., of "Shawlands," Carshalton Road, Sutton, who died from heart failure, after a fortnight's illness, on the previous Friday. The news of his death came as a great shock to his many friends; for he was out and about until as recently as Christmas Eve. He leaves a widow, three sons, and two daughters, all of whom are grown-up. Mr. Drew, who had for many years been a prominent figure in gas finance, was born at Forest Hill, in 1861, and, on leaving school, entered the employ of the late Mr. Alfred Lass. The business was subsequently known as Messrs. Wood, Drew, & Co., Chartered Accountants. No. 139, Cannon Street, E.C., of which firm Mr. Drew became senior partner on the death of Mr. Wood, a few years ago. The firm specialized in the auditing of the accounts of gas and water companies; and in this work Mr. Drew was one of the leading experts. As he said at the special meeting on Dec. 21 last of the Sutton Gas Company (of which he had been one of the Auditors since 1915), he had had an experience of forty years in connection with many gas companies, and had been engaged in a large number of arbitrations. He was associated, in a financial capacity, with dozens of gas companies, as auditor, accountant, director, or secretary, or simply called in as financial adviser. On the retirement of Mr. Lass, he undertook temporarily the Secretaryship of the Barnet District Gas and Water Company, which appointment was permanently confirmed in 1899. In addition to this, he was Secretary to the Riddings District Gas Company. He was a Director of the Harpenden District Gas Company, and had also assisted in a like capacity the South Oxfordshire Water and Gas Company.

NATIONAL GAS COUNCIL.

Meeting of the Central Executive Board.

A MEETING of the Central Executive Board of the National Gas Council was held on the 11th inst., at No. 30, Grosvenor Gardens, S.W. Mr. Alderman Phillips (Salford) was voted to the chair, pending the election of a Chairman for the ensuing year.

CHAIRMAN AND VICE-CHAIRMAN.

Mr. D. Milne Watson and Mr. Alderman Phillips were unanimously re-elected Chairman and Vice-Chairman, respectively, of the Central Executive Board.

COAL SUPPLIES.

With reference to the coal position, an interview was reported between the President and officers of the Council and the Secretary for Mines (Mr. W. C. Bridgeman, M.P.), on the 21st ult., when the Council pressed for a more equitable and suitable allocation of coal to gas undertakings.

HIRE OF WAGONS.

With regard to wagon hire, it was agreed by the meeting that steps should be taken by the Council to get the owners of private wagons generally to agree to a maximum rate of 1s. per ton for short journeys of up to 20 miles. At present this rate was only quoted by a small number of owners; the remainder pressing for a minimum rate of 2s. for 75 miles.

GAS REGULATION ACT INQUIRIES.

It was reported that no Order had yet been made under the Gas Regulation Act, but that an inquiry had been held at the Board of Trade on the 4th inst., in connection with the application of the Gas Light and Coke Company for an Order under section 1 of the Act.

A hearing was also reported at the Board of Trade on the 10th inst., with regard to the opposition of the railway companies in connection with the above application. It was now in the hands of the Board of Trade how they would meet the railway companies' objections under the Act.

RAILWAY RATES ADVISORY COMMITTEE.

Mr. S. S. Ogilvie gave a *résumé* of the report of the Railway Rates Advisory Committee, which is most satisfactory, in that it bears out many of the views expressed by the Council in evidence before that Committee. A summary of the evidence will appear in the Council's monthly report issued to members.

ELECTRICITY SUPPLY (No. 2) BILL.

Mr. E. J. Fottrell reported upon the Electricity Supply (No. 2) Bill, clause 16 of which gives power to the owners of any railway generating station or station erected under statutory authority for the purpose of working tramways or light railways, to supply electricity to Joint Electricity Authorities, to any authorized undertaker whether within or not within the district, and to any consumer, subject to the consent of the authorized undertaking supplying the particular area in which the consumer's premises are situated.

It was agreed that the Council should take steps with a view to safeguarding the interests of the gas industry under the Bill.

THE MODEL BILL.

It was reported that the Committee appointed by the Council to consider the clauses of the Model Bill had been communicated with on the desirability of certain amendments to the Bill. It was decided to call a meeting of the Committee shortly, to consider all the points raised.

LIFE OF GAS-METERS JOINT COMMITTEE.

It was reported that the Life of Gas-Meters Joint Committee of the Institution of Gas Engineers confirmed their recommendation as to the standard sizes of dry meters, as follows:

Number.	Capacity per Hour.	Capacity per Revolution.	Revolutions per Hour.	Bore of Connections.
	C.Ft.	C.Ft.		Ins.
1	30	0·125	240	¾
2	40	0·166	240	¾
3	60	0·25	240	¾
4	120	0·5	240	1
5	210	1·0	210	1¼
6	420	2·0	210	1½
7	540	3·0	180	2
8	720	4·0	180	2½
9	900	6·0	150	3
10	1200	8·0	150	3
11	1800	15·0	120	4
12	3000	25·0	120	5

PIPE PRICE VARIATIONS.

It was stated that, at the request of the Sub-Committee on Trusts under the Profiteering Acts, the Council were collecting information from their members as to the variation in price of the different sizes of pipes supplied to their undertakings from 1914 up to the present time.

NEW FACTORY AND WORKSHOP REGULATIONS.

With regard to the new draft regulations under the Factory and Workshop Act, which include certain portions of gas-works under the heading "Dangerous and Unhealthy Industries," it was reported that the Council had been approached by the coke-oven industry and the Association of British Chemical Manufacturers with a view to joint action for the purpose of obtaining the exclusion of the various works from the regulations.

THE COKE MARKET.

It was agreed that the Council should co-operate with the London Coke Committee with a view to finding improved local markets for coke.

CONTRACT PRICES.

A meeting was reported of the Joint Committee of the Council and the Society of British Gas Industries on the question of contract prices, when the Society promised to consider the question of submitting a monthly list showing the advances or decreases during the month in prices of raw material in different localities.

INCREASED TELEPHONE RATES.

The Council were given authority by the Central Executive Board to lodge a protest on their behalf against the proposed increased telephone rates.

THE GAS INDUSTRY ON THE HEAT-UNIT BASIS.

Special Articles.—III.

LAST week the special articles treated of the production of heat units and the bearing of utilization upon the control of production. This week the contributions are upon the transmission of the heat units to the consumers. With the production of gas of a lower grade in respect of calorific power per cubic foot, there will be in some areas distribution difficulties to be negotiated and problems to be solved. They are dealt with by Mr. Walter Hole, of Leeds, who is well known in the gas industry for his work as a gas distributing engineer; and the *rôle* that high pressure will in future take in the work of distribution is the subject of a contribution by Mr. B. R. Parkinson, whose investigations into distribution matters have supplemented prior knowledge. His contributions to the meetings of the Institution of Gas Engineers, in conjunction with the work of Mr. J. G. Taplay, the Chemist to the Life of Gas-Meters Research Committee, will be recalled with interest.

DISTRIBUTING BRITISH THERMAL UNITS.

By WALTER HOLE, of Leeds.

WHAT does it matter from the point of view of distribution, as distinct from utilization, whether the gas distributed is rated in therms or in cubic feet? This is the question which the writer has heard more than once; and if stated in these bald terms, the answer must be, "None whatever." A certain volume of gas contains a definite number of B.Th.U. It is quite immaterial, in this connection, whether the account for the sale is made out in terms of the volume containing the B.Th.U. or of the B.Th.U. contained in the volume. Both have to be distributed before any charge at all can be made. But this is to take a very superficial view indeed. As stated, the above begs the question, and does not correctly cover the facts. It will not be difficult to show that the matter is not quite so simple as the question suggests. On the contrary, it is rather complex, and contains elements which are incalculable and about which it is impossible to do more than generalize.

CAUSES OF THE CHANGE-OVER.

The subject cannot be properly considered without taking into account the events which have led up to the change. These may be very briefly stated. For many years now gas has passed from a lighting to a heating agent. Even when used for the production of light, it is by means of the secondary process of heating-up an incandescent mantle, so that the manufacture and distribution of a gas capable of giving a highly luminous flame have become uneconomical processes. Then the exigencies of the late war opened up an enormous demand for benzole. The gas produced at most of the big works in the country was severely stripped of its light oils to meet the demand, and was thus deprived of its most valuable luminous constituents. The general public therefore discovered in actual practice what the profession had for long urged—that the heating properties of the gas were but very slightly affected by this treatment. A lower-grade gas proved, broadly speaking, in no wise inferior for use with an incandescent mantle to gas of a much higher illuminating power; and the same was true when the gas was used for heat production in domestic and industrial operations. It was therefore terribly wasteful to distribute and burn these constituents which were so valuable as bye-products. They could be much more fittingly and economically utilized in other ways.

CONSERVATION OF NATIONAL RESOURCES.

The general impoverishment caused by the war has also led to an insistent demand for the proper conservation of the national resources. Of these, the raw material for gas making, coal, is one of the most important. The investigation as to how this conservation may best be accomplished in our own industry has led, by very different paths, to the same result. It is now an accepted fact that these resources are best utilized in the production of gas of lower calorific power than was thought to be desirable a few years ago. The only difference of opinion now is as to how far the industry shall proceed along these lines. Putting these things together, therefore, we are faced with the fact that the change-over is not simply from a volumetric to a thermal basis of charge, as such, but is also most intimately associated with the supply of a lower-grade gas, and of a gas denuded to a large extent of its light oils.

The question, therefore, is what bearing this change-over will have upon distribution. Before attempting to supply an answer, it will be well to review the conditions which have been handed down to us, and under which we are working to-day. A clear statement of them will go a long way to supplying the answer. In considering them, we must recognize the fact that we are just now in a transitional period. We are standing for the moment on a broad belt of ill-defined "no man's land" lying between the opposite principles of supplying an illuminating gas or a gas for purely heating purposes. Many have traversed a great deal of this ground. Others not nearly so much. But whatever the local position at the moment may be, all eyes and thoughts are turned in the latter direction. It behoves us, therefore, to look the facts fairly and squarely in the face, and consider all they involve.

OVERTAXED SYSTEMS.

The distribution of a lower-grade gas certainly involves dealing with larger quantities. If, for a certain duty, a definite volume of 550 B.Th.U. gas is required, then it is obvious that for the same duty a larger volume of gas of a calorific value of, say, 450 B.Th.U. will be needed. There may be compensations in other directions which affect the percentage of the increase, but when full allowance has been made for them, the fact still remains that larger volumes will be required. This additional quantity must be passed through the system of mains. And so with the aggregate of consumptions which go to make up the total output of any undertaking. It is well known, however, that in pre-war days many undertakings were working well up to the delivering capacity of their system of mains, or with a very slight margin indeed. In many directions one heard of distributing systems becoming overtaxed and inadequate. The heavier loads involved in dealing with a lower-grade gas must, therefore, inevitably involve serious consideration of the question of how the canalization of any undertaking can be made to bear these loads.

If this was true of pre-war days, how much more so to-day? The five years of war caused absolute stagnation in all improvement schemes. The resources of the nation were urgently needed in other directions; and the best thought-out schemes had to go by the board. There is therefore considerable leeway to make up, due to the lapse of time at war. And even now, when the stress of foreign war is two years past, the conditions as to the costs are very serious. They make the carrying-out of even the most necessary schemes almost prohibitive.

HOUSING SCHEMES.

Furthermore, there is just now considerable activity in the building trade. Serious attempts are being made to meet the lamentable shortage of houses for the people, which has meant the opening-up of large numbers of new building estates. These are almost invariably on the outskirts of our towns and cities, where the existing conditions, from a supply point of view, are often quite inadequate for present needs. Provision for these additional loads must therefore be taken in hand, apart altogether from any alteration of standards.

SPECIFIC GRAVITY OF GAS DISTRIBUTED.

Then again, from a distributory point of view, perhaps insufficient attention has been paid to the fact that the gas of the future will be of greater density than in the past. Other things being equal, the volume transmitted, for any loss of head through any pipe, is inversely proportional to the square root of the density. At the time Dr. Pole educed his famous formula, the specific gravity of the gas distributed was about 0·4 (air = 1). Newbigging's tables, in accordance with which a large proportion of our distributory systems have been planned, also assume a specific gravity of 0·4. Should the specific gravity be raised, considerable shrinkage in the volume transmitted must be expected. If the specific gravity is raised to 0·6 (a very moderate figure), a delivery of 100 volumes at 0·4 specific gravity will fall to 82 volumes at the former density. So that, at a time when a greater volume will be required for equal duty, the rise in specific gravity involves a diminished delivery, other things being equal.

ACCELERATED CORROSION.

A further disturbing element is found in the rapidly increasing amount of corrosion which is now taking place in our mains and services. It does not fall within the scope of this article to discuss either the causes or the cure of this. Whatever they may be, there is no doubt of the fact itself. The effects of this are threefold. In the first place, deposits reduce the free gas-way through the pipe; they reduce the cross-sectional area, in many cases very considerably, and practically degrade the pipe to one of lower diameter, with proportional loss of transmitting power. In the second place, the corrosion forms a much rougher surface than that of a clean pipe, and therefore augments very greatly the skin-friction retarding the rate of flow. And in the third place, the corrosion deposits, owing to their unequal character, set-up eddies in the flow itself, which again materially interfere with the volume transmitted.

STATION GOVERNORS.

The denudation of the gas of its light oils, which is partly responsible for the increase of corrosion, has effects also in two

other directions in connection with supply. One of these is seen in the imperfect working of station governors, particularly where these are fitted with Cowan valves. Hitherto these valves have been lubricated by the oils in the gas; and so free and easy motion has been maintained. Now, however, in the absence of these lubricating oils, fine deposits of a dry character are being formed on the seats and contact surfaces of the valves. These introduce friction, and impede regular and easy working. If allowed to remain long enough, they prevent the valve sliding, and throw the governor out of action.

Naphthalene Troubles.

A further effect of denudation is found in the increase of naphthalene troubles. Freedom or otherwise from these worries is not dependent so much upon the absolute quantity of naphthalene present in the gas, as upon the carrying power of the light oils it contains. In other words, it depends upon the saturation point of the gas for napththalene. With a low saturation point, 3 or 4 grains of naphthalene per 100 c.ft. may give serious trouble, whereas with 10 or 12 grains present, no great difficulty may be experienced when the saturation point is correspondingly high.

Pressures.

Lastly, the Act enforces a very considerable advance in permissible minimum pressures. The minimum of 2 inches head of water on any main or service of 2 inches diameter and over has been felt by many gas engineers to be very onerous. But it only gives statutory insistence upon what is already being done by all alert undertakings. Even in pre-war days, the distributory system which was not as efficient as that was very faulty and imperfect. In any case, whether already done or not, whether required by the Gas Regulation Act or not, it is quite certain that the supply of lower-grade gas involves the distribution of the gas at higher pressures. Undertakings will be simply compelled to raise their standards of pressures, in order to satisfy the demands of modern gas apparatus. Why anyone should hesitate at all in this matter is difficult to comprehend. There are, of course, the exceptional cases of mining districts, which are liable to subsidence, leading to broken mains. But apart from these, we suspect that the old bugbear of leakage is really at the bottom of the objection. If those who are fearful would only remember that while it is quite true that a leak from a bared gas-pipe is directly proportional to the square root of the pressure, the result is very different if the pipe is covered in the ground, and tightly packed round with earth, clay, and other more or less impervious materials. Twenty years ago in Leeds, we were working at a daytime pressure of 15-10ths, and a maximum night pressure of 25-10ths. Our leakage then was in the neighbourhood of 10 p.ct. To-day we have fully an inch more pressure on throughout the 24 hours, and our leakage has dropped to roughly 6 p.ct. But even if there were to-day anything substantial in this objection, it would probably be cancelled-out by the gain due to the rise in specific gravity of the gas. Leakage is approximately inversely proportional to the square root of the density.

It is worthy of remark in passing that the Gas Regulation Act gives the Board of Trade power to prescribe different minima of pressure for different qualities of gas, and also for different districts within the same area of supply. Presumably, the two inches head of water would always be the absolute minimum. The power to vary the minimum pressures will need exercising with a great amount of discretion. It will be conceded that pressures must inevitably be raised with every considerable decrease in calorific power; but different minima in different districts in the same area may give rise to considerable difficulty. Districts are not to-day completely shut-off from each other; and it might easily happen in practice that the higher prescribed minimum pressure would become the actual minimum for the whole area.

Briefly summarizing the various points enumerated above, we find that:

1.—For equal duties with lower grades, we must distribute a larger volume of gas.
2.—This increase of volume will also be of a gas of greater density than before.
3.—The necessity for this greater delivery coincides with increasing demands on the outskirts of the area of supply.
4.—Measures for keeping distributing plant abreast of requirements have been arrested for five years during the war, leaving a tremendous leeway to be made up.
5.—Simultaneously with these increased demands, our distributing plant is becoming less effective, owing to corrosion deposits.
6.—With the demand for increased volumes comes also the demand for increase of minimum pressure.

Compensations: Levelling the Load.

Fortunately, over against these things we have two compensations, one of them of the very first importance. During the last quarter of a century the day load on our distributory system has become much more evenly spread over the hours of supply. When gas was used primarily as a lighting agent, as was to be expected, the lighting hours showed a huge peak load. With the development in the use of gas for a large number of domestic purposes—cooking, heating, hot water supply, &c., and more recently the great demand for gas for innumerable industrial operations—the previous peak has been brought down very much indeed. In fact it has been almost obliterated in many undertakings in industrial centres. Whereas thirty years ago the gas output was largely concentrated in the evening hours, it is now fairly even from early morning till late at night.

We have indeed no need to go back thirty years to see this marked alteration in load. I take for comparison a typical December day's output just before last Christmas, and find that on this day, with an output of 12½ million cubic feet, no less than fifteen hours show an output greater than the average for the twenty-four. The last previous normal year with which a comparison can be made in Leeds is 1912. On a similar day in that year there were only eight hours which showed an output greater than the average for the whole twenty-four. In place of the previous lighting-load peak, we are gradually approaching a condition when we shall have a fairly high tableland of supply running more or less regularly over the eighteen hours from 6 a.m. to midnight. The result is that mains laid to cope with a daily output which was concentrated largely within a few hours of the day, have proved adequate to deal with far larger daily quantities now that these have been spread over (say) three times the number of hours. Had it not been for this, a far greater tuning-up of the distributory systems would have proved necessary than has actually been the case. But we are rapidly approaching a time when this compensation will be no longer available, owing to the reserve being overtaken.

Relief in Old Residential Districts.

Concurrently with this spreading of the load has come, in many undertakings, a lessened demand in the older residential districts. This has still further relieved the embarrassment which would have been experienced in dealing with the increased output under former conditions. In other areas, however, these districts have become altogether changed in character. From being residential they have become commercial or industrial; and new conditions have brought their own demands. These in many cases have been much greater than those previously made; but relief has been experienced, inasmuch as the load is a day and early evening rather than a lighting load.

These, in brief, are the conditions which in a greater or less degree confront us to-day, and will undoubtedly face us in greater measure in the immediate future. The problem is how they may best be met.

Larger Mains and Services.

The first step will certainly be the elimination, as far as all new or replacement work is concerned, of the smaller sizes of mains and services. The old familiar 2-in. and 3-in. mains have rapidly been becoming inadequate for modern needs; and the B.Th.U. will doubtless give them their quietus. So with ½-in. and ¾-in. services. In other circumstances they have done good work; but now they must be classed as obsolete, as is the flat-flame burner. The minimum size of our mains in future should be not less than 4-in. internal diameter, and services of not less than 1-in. pipe. This is an advance on present standards which will be absolutely necessary. It will not only ensure adequate carrying capacity in view of possible obstructions, but incidentally give an added structural strength to the canalization. The additional cost will not be so great as it may appear. The difference in labour costs between a ¾-in. and a 1-in. service, or between a 3-in. and a 4-in. main is practically negligible. The slight additional cost will be that due to the difference in values between the two sizes of pipes, which will be amply recompensed by the advantages gained.

Boosting.

The second line along which the problem will be grappled with, and solved, will be that of a very considerable extension of boosting systems. Those who already have such plant in operation will probably find it necessary to provide for its expansion; those who have not, will undoubtedly find it necessary to instal it. Practical experience of the working and advantages of boosting plant are becoming very common, and is so favourable as to give every encouragement to those who hitherto have not found it necessary to embark on such a scheme. The only alternative would be a considerable reconstruction of trunk-main systems, accompanied by an appreciable enlargement or supplementing of many service mains. Work along these lines was extremely costly even in pre-war times, and is absolutely prohibitive at present prices. We therefore come back to a system by which an appreciable portion of the whole output is carried at high pressure, to feed at selected points the existing low-pressure system. This of course involves the installation of compressors, special mains, sub-stations and governors; but even so, the cost is much less than would be the alternative method of recasting existing distributory systems.

Constant Pressures.

The installation of boosting plant also gives us the means of grappling with another need which will become more clamant in the future—namely the maintenance of fairly constant and adequate pressures. Under the old conditions of a richer gas, the need was becoming increasingly felt. With a lower-grade gas in use it will become imperative. The ideal is unquestionably to give a gas service of constant quality and at adequate and constant pressures. With the former, this article has no concern. The latter, under the normal conditions of a low-pressure supply, is impossible over those large areas of supply which need it most. There are only two ways of attaining the ideal. One is to raise the pressures sufficiently over the whole of the distributing system and then govern-down at each consumer's service. This is

obviously a method which is cumbrous and costly. It is also uneconomical, inasmuch as over a varying extent of the area of supply more work is done than is absolutely necessary. We come back therefore to the provision of some form of boosting. There can be little doubt that the most efficient method of applying the principle of reinforcement of pressures is by means of "girdle mains." For this purpose we may utilize the ring roads, which are now being, or are about to be, constructed round many of our large towns and cities. These more or less encircle the whole area of supply, and enable us to lay a girdle of high-pressure mains. From these, existing systems may be fed through suitable governors. They would also form a base from which extensions still further afield might be supplied. It will be seen at once what a flexibility such a method gives to the whole system of supply, and what control over pressures and distribution generally it gives to the distributing engineer. The girdle main forms at once a reservoir from which, and a channel through which, supplies may be drawn wherever required and under all working conditions. Any extraordinary demand at any part is immediately and adequately met, and the supply on the low-pressure system under all conditions is made as nearly constant as is humanly possible.

Similar advantages, but to a less degree, attach to the half-way house of the single boosting main. This accomplishes at one point what the girdle main does at many. As far as its influence extends, conditions of supply are stabilized and pressures are maintained. These are the only practical ways in which the needs of the consumer can be met and, in vast numbers of cases, the demands of the Gas Regulation Act in the matter of pressures be conformed to.

Cyanogen Recovery Plant.

The corrosion difficulty will have to be grappled with seriously. Two methods at once suggest themselves. The first is by the elimination of much of the corrosive activity, by means of the installation of cyanogen recovery plants at the works, and the removal of the cyanogen compounds. These are expensive plants to put down; and excepting in the case of the largest works, the plant would not pay if considered merely by itself. But when considered in relation to the larger problem, this ought to have little weight. If the installation of such a plant, even working at a loss, is going to save thousands of pounds in another direction, it is surely in the larger aspect a paying proposition. For there can be no doubt that if the corrosion which is now proceeding continues unchecked for a comparatively few years longer, many gas undertakings will be faced with a problem that will be of a very serious character indeed.

Greasing the Pipes.

Another method by which the extent of the evil may be mitigated is that which has come to be known as greasing the pipes. In past years, one great prevention of corrosion has been the painting of the internal surfaces of the pipes by the light oils present in the gas; and by reproducing these conditions a great deal of corrosion can be prevented. The conditions may be reproduced in large measure by the introduction into the stream of gas passing through the mains of light oils in the form of either vapour or fog. This in its travel is deposited on the internal wall of the pipe, and forms a protective coating against corrosion. The spray method may be easily applied at any works where some form of pressure is always available. When this is done, incidentally, governor troubles are greatly decreased; but it will be quite insufficient in itself for the whole of the mains and services. The operation will diminish in effectiveness with the distance from the works. It is therefore necessary to supplement it at a good many points, over a wide-spreading area of supply. Fortunately there are two very easy ways of doing this. One is to insert a Horsley syphon at a suitable point on a length of main, build a brick or concrete substation round it, fit it with thermometer and special pipes for filling it with light oils from the outside, heat it up by means of a tubular burner, and allow the vapour to travel with the stream of gas. This is the plan adopted at Leeds, where we have ten syphons working. These were installed primarily to deal with the naphthalene trouble, and are now combining the two services. The carrying forward of the vapour has the further advantage of lubricating dry-meter valves, and effectively and automatically spraying the meters *in situ*. Thus three birds are killed with one stone.

A second method of greasing is to use town's pressure of water to displace light oils from a large container, through a spray, into the stream of gas in the main. This is done by means of a small boiler-plate cylinder, which is connected-up at the bottom to the water main. A control cock and back-pressure valve are inserted in the connection; and the cylinder is fitted with a U-tube to indicate the level of the oil. From the top of the cylinder a pipe is run to the sprayer fixed in the main to be treated. The cylinder or small boiler having been filled with oil, the water is turned-on, and forces the oil through the sprayer at a pressure equivalent to the pressure in the water main. When the whole of the oil has been displaced, the water control cock is shut-off and the tank emptied of the water which had displaced the oil. The tank may then be refilled with oil, and the cycle of operations recommenced.

Special Gas for Industrial Purposes.

Perhaps one of the most important provisions of this epoch-making Act is that relating to the distribution of special gas for industrial purposes. Many of our gas-works are situated in the midst of industrial areas. There must, therefore, be within easy reach of such works many establishments to which the supply of large quantities of cheap, low-grade gas would be a great boon. With our present manufacturing methods, it would be easy, and might be made profitable, to supply such gas. It would have to be compressed, distributed at high pressure, and governed-down on consumers' premises. This could be done very economically and cheaply. The special mains would be small in comparison with the bulk transmitted, and interest and sinking fund charges be proportionately insignificant per unit volume, if there were a considerable and regular demand. Altogether, when the potentialities of the position have been fully realized, and worked, we believe that this provision of the Act will stand-out as one of the wisest and most beneficial of them all.

Measurement.

Having brought our B.Th.U. to the consumer, the question arises, What about measurement? Here again we are met by the necessity of providing larger measuring capacity. The existing 2 and 3 light meters must go, and as quickly as possible—or we shall defeat the purpose of the adoption of larger service mains. But meters of larger capacity, as made at present, would be too cumbersome, and take up too much room in the restricted space available in small property. We may, however, confidently anticipate the placing on the market of meters of larger capacity for equal size, so that one to pass 60 c.ft. per hour shall not take up much more space than the present 5-light meter.

Another development in connection with the measurement of B.Th.U. will be to make our index train of wheelwork do a great deal of the clerical work which, under the Act, will have to be done by the office staff. Not only economy of clerical labour, but also the satisfaction of consumers, will render this imperative within a short time. It will be found in practice very unsatisfactory to record in cubic feet gas passing through meters, and make our accounts out in terms of therms. It is the kind of thing to make the average man suspicious. He likes to check his account. This checking should be made as easy as possible for him; for he is particularly susceptible to even the remotest suggestion of non-straightforwardness. When you touch an Englishman in his pocket, you touch a very tender spot. He will claim some simpler method than having to turn the cubic feet of the index into therms by a long calculation. We may anticipate therefore a demand for meter indexes which will themselves read in therms, instead of in cubic feet; and it is difficult to see how the demand can be resisted. It is only a question of time. Before long we shall be having our meters fitted with what I may call a thermal index. The transitional period will be difficult; but that is a condition common to all transitional times.

HIGH-PRESSURE DISTRIBUTION OF B.TH.U.

By B. R. Parkinson, M.I.Mech.E.

The line of distinction between low and high pressure gas may be taken at the point where the volume of the gas becomes appreciably affected by compression. The usual engineering error is 2 p.ct.; but the mean error in registration allowed under the Sales of Gas Act (not referring to compression) is 2½ p.ct. Adopting the latter, and taking 4 inches water-gauge pressure for every 1 p.ct. reduction in volume, the 2½ p.ct. limit is equivalent to 10 inches pressure. Ten inches water-gauge, therefore, will be the physical line to draw between the terms low and high pressure.

High Pressure and the New Standards.

The changed basis of gas supply might, under normal conditions, be expected to give an impetus to high-pressure distribution, but the present state of high costs and low capital make engineers more than ordinarily cautious in the consideration of any system which is scarcely out of the experimental stage. Nevertheless, there are important considerations which bring the question of increased pressures to the front at the present time; and these shall be detailed later. It will be of interest, by way of introduction, to indulge in some reflections on possibilities, even suggesting practice far removed from that which obtains to-day, and try to ascertain what is and what is not practicable.

The Practice of a Century.

It is, indeed, strange that coal gas has always been stored and distributed with its bulk at atmospheric pressure, or practically so. The extraordinary nervousness with which gas was regarded when first introduced a century ago is not apparent to-day; but it has left its mark, in that we still continue to handle our product in the delicate atmospheric manner, although there are abundant opportunities for packing it away in a small space and consigning it accordingly. Water has always been driven through mains under more or less high pressure; and water is incompressible. Gas offers the advantage of reduction in bulk both for storage and transmission. When gas was first produced, compressing machinery was unknown; but to-day the literature on compressed air would fill a library. Air and other gases are compressed to 300 atmospheres (4500 lbs. per sq. in.), and boilers holding steam at high pressures are so common, and so well controlled in regard to safety, that we forget them. Yet coal gas jogs along in the

old atmospheric way as though it had a right to stretch itself out and take up as much room as the air we breathe.

IF GAS HAD BEEN DISCOVERED TO-DAY.

Let us first of all suppose that gas as a fuel has just been discovered and placed on the market to-day with its thermal basis. Following late after all the mechanical and electrical power schemes with which we are now familiar, it is received without hesitation. Assuming all that is up-to-date in gas manufacture as directed by the chemist, is it not probable that the product would be immediately handed-over to compressed air experts for storage and transmission? Would anyone have thought to build the enormous gasholders to which we have become gradually accustomed, reaching in one unit to a capacity of 12 million c.ft.? This is a question that may be answered by working-out an extreme high-pressure case as a supposition—theoretically possible, but open to question on the score of cost. Comparative costs may at any time be upset by invention or discovery.

AN IMAGINARY HIGH-PRESSURE SCHEME.

Let us imagine a fairly large undertaking of 1000 millions per annum. Gas is made into a small relief holder, and immediately compressed to 20 atmospheres (300 lbs. per sq. in.). Some of the purification and extraction is effected by the compression, and this results in a considerable saving in manufacturing plant. The gas may be compressed into cylinders, and, for a storage capacity of 5 millions, we should require 250 cylinders, each 5 ft. diameter and 50 ft. long. But for this diameter it would be necessary to have 1 in. thickness of metal; and therefore a smaller diameter with greater length would be preferable. A 38-in. continuous cylinder laid down as a trunk main, 6 miles long, with $\frac{5}{8}$ in. thickness of metal (mild steel), would take the whole storage of 5 million cubic feet at 300 lbs. compression. The storage would then be localized, and, by means of valves, the line could be cut and isolated from time to time for connections and repairs. The minimum size of main required for the transmission only of 500,000 c.ft. maximum hour for 6 miles at 300 lbs. pressure, reducing to 100 lbs., would be 6 in.; but the 38-in. main would take both storage and transmission with a loss of pressure inappreciable. From the 38-in. or 6-in. trunk main the gas might be distributed at the reduced pressure of 100 lbs. per sq. in. through 50 miles of subsidiary feeder mains, 1 in. in diameter; and thence into district governors for further distribution at (say) 5 lbs. per sq. in., in 100 miles of $\frac{3}{4}$-in. mains, to consumers' services. Individual governors would cut down to low pressure or whatever was required on consumers' premises. The storage that would be taken up by a 6-in. trunk main and the 1-in. and $\frac{3}{4}$-in. subsidiary mains at their various pressures would be about 100,000 c.ft. Various automatic devices would be provided to cut-off the high-pressure gas in case of accident to any of the mains. The total length of mains would be 156 miles, which would be normal to an undertaking of 1000 millions per annum. The sizes of mains are worked-out according to capacity, as an example of extreme high-pressure distribution.

HIGH-PRESSURE STORAGE EXPENSIVE.

Where the system on a large scale would break-down, and the dreamer be rudely awakened, is in the contemplation of high-pressure storage cylinders in substitution for gasholders. The weight of metal in the 250 cylinders would be four times as great as that of a 5-million gasholder of 200 ft. diameter, or twice as great as that of a number of smaller holders of 100 ft. diameter and the same total capacity. If, in place of the large cylinders, a 6-miles length of 38-in. main were laid, the total weight would be the same; but there would be a saving of the 6 miles of 6-in. pipe (about one-twentieth of the weight of the 38-in.). Whether there would be a saving in labour costs shown by welded cylinders or pipes, as compared with riveted gasholders is another factor to be taken into account; but unless there be a considerable saving in first cost, it must remain clear that the storage of gas on a large scale under atmospheric conditions remains the more economical. The cost of compression will need to be set against the saving in capital outlay on mains; for it is clear from the foregoing that storage economy *per se* cannot help to bear it, although with any high-pressure system a certain amount of reserve high-pressure storage offers numerous advantages.

Having therefore narrowed-down the subject by cutting-out high-pressure storage on the large scale, it will be useful to ascertain what reduction in diameter of mains is offered by high-pressure distribution.

PRESSURE AND DIAMETER OF MAINS.

Water requires pressure for transmission varying inversely as the fifth power of the diameter of the main ($p\ d^5$). Gas at low pressure, according to the simple formula in common use, follows the same proportion. This means that with a main of half the diameter, the pressure will have to be increased 32 times—*i.e.*, 2^5—for an equal discharge. With high-pressure gas we find the expression p (representing head of pressure in inches water-gauge) replaced by $P_1^2 - P_2^2$, representing initial and final pressures in pounds per sq. in.; and this latter has reference not only to motive pressure, but to reduction in bulk during transmission, involving an increase in quantity due to compression. Thus, if gas were transmitted at 10 lbs. pressure through a main of given diameter, it would be possible to deliver the same quantity of gas through a main of half the diameter with a pressure of 100 lbs. Here the increase in pressure is 10 times, instead of 32 times; and from low pressure up to 100 lbs. per sq. in. there is a gradual reduction in the rate of pressure increase required (for half the size of main) from the factor 32 to the factor 10, it being understood that the pressures mentioned are absorbed in transmission.

PRESSURE AND VOLUME OF GAS.

A more attractive way of expressing the advantage that can be gained by compressing gas through pipes is to state the increase in terms of free gas delivered. If a given volume of low-pressure gas can be passed through a pipe of given length and diameter with a loss of 1 in. pressure, the following figures will show how many times as great a volume can be delivered at higher pressures:

Pounds per sq. in.	1	3	5	10	20	30	40	50	60	70	80	90	100	200	300
Multiple	.	.	.	5	10	13	20	31	42	53	63	73	83	94	104	114	215	315

Thus, if 1000 c.ft. of gas per hour can be delivered through a 4-in. main, of length 2 miles, with a loss of 1 in. pressure, the quantity transmitted at 5 lbs. would be 13,000 c.ft.; at 50 lbs. 63,000 c.ft.; at 100 lbs. 114,000 c.ft.; and at 300 lbs. 315,000 c.ft. For still higher pressures, we merely add 15 to obtain the multiple. Thus at 1000 lbs., multiple 1015, quantity 1,015,000 c.ft.; at 3000 lbs., multiple 3015, quantity 3,015,000 c.ft.—all through the same size of main as we can pass 1000 c.ft. by low pressure. An extreme case might be taken to illustrate the possibility of long distance transmission of large quantities of gas. Fifty miles of 12-in. main, at low pressure (1-in. head), would pass 3200 c.ft. per hour. At 3000 lbs. pressure, the pipe would take nearly 10 million c.ft. per hour. The pipe at its commencement would have to be of high-tensile steel with $1\frac{1}{4}$-in. thickness of metal, reducing in gauge as the pressure dropped.

DIAMETERS OF MAIN FOR VARIOUS PRESSURES.

A third way of setting-out the claims of high pressure is shown by the table below, which compares the diameter of main required at different pressures. It is based on the expression $\frac{D}{d} = \sqrt[5]{P_1^2 - P_2^2}$, where D and d are the diameters of low-pressure and high-pressure mains respectively.

HIGH-PRESSURE INSTALLATIONS.

In concluding this survey by reference to existing practice, it may be said that pressure-raising up to 5 lbs. per sq. in., chiefly

Diameter (Inches) of Main Required for Low Pressure.	Diameters (Inches) of Main Required to Deliver the Same Quantity of Gas by High Pressure.										
Loss of 1 inch.	3 Lbs.	5 Lbs.	10 Lbs.	15 Lbs.	20 Lbs.	25 Lbs.	30 Lbs.	40 Lbs.	50 Lbs.	75 Lbs.	100 Lbs.
3	1¼	1	1	¾	¾	¾	¾	..	..	..	..
3½	1½	1¼	1	1	1	¾	¾	¾	¾	..	..
4	1½	1½	1¼	1	1	1	1	¾	¾	¾	..
5	2	1¾	1½	1¼	1¼	1¼	1	1	1	¾	¾
6	2½	2	1¾	1½	1½	1½	1¼	1¼	1¼	1	1
7	3	2½	2	2	1¾	1¾	1½	1¼	1¼	1¼	1
8	3	3	2½	2	2	2	1¾	1¾	1½	1¼	1¼
9	3½	3½	3	2½	2½	2	2	1¾	1¾	1½	1¼
10	4	3½	3	3	2½	2½	2	2	2	1¾	1½
12	5	4½	3½	3½	3	3	2½	2½	2½	2	1¾
14	6	5	4	3½	3½	3½	3	3	2½	2½	2
15	6	5	4½	4	4	3½	3½	3	3	2½	2½
16	6	6	5	4½	4	4	3½	3½	3	2½	2½
18	7	7	6	5	4½	4	4	3½	3½	3	2½
20	8	7	6	5	5	4½	4½	4	4	3½	3
22	9	8	7	6	6	5	5	4½	4	3½	3½
24	10	9	7	6	6	6	5	5	4½	4	3½
27	11	10	8	7	7	6	6	6	5	4½	4
30	12	11	9	8	8	7	7	6	6	5	4½
36	14	13	11	10	9	8	8	7	7	6	5
42	17	15	13	11	11	10	9	9	8	7	6
48	19	17	15	13	12	11	11	10	9	8	7

for feeder mains, has in this country long passed the experimental stage, and has become established as an economical success. Higher pressures, such as 25 lbs. per sq. in., have also been tried on the small scale and have been successful technically; but costs are not available that can give any idea at present of the economy of dealing with large quantities of gas at pressures of 25 to 50 lbs. Mr. Stephen Lacey, the Distributing Engineer to the Gas Light and Coke Company, in his recent paper before the London and Southern District Junior Gas Association, in a brief reference to high-pressure distribution, remarked that the cost of pumping has not, in his opinion, been sufficiently considered when high-pressure schemes have been initiated. There, however, we are in the hands of the compression experts; and invention is moving fast in that direction.

Three good reasons may be given for considering high-pressure distribution at the present moment.

I.—*Increased Gravity and Volume.*

A calorific power gas with higher specific gravity, or a lower-grade gas with greater volume will require larger mains or greater pressure. Increase in specific gravity requires increase in pressure in direct proportion. Increased volume requires increase of pressure as the square of the volume, which is more serious. Let us put these statements into figures. The specific gravity of gas increasing from 0·45 to 0·60 requires an increase of pressure from 3 in. to 4 in. Unless a low-grade gas is going to give the same efficiency as a high-grade, or assuming the contrary, a reduction in calorific value from 550 to 450 B.Th.U. should require an increase in volume from 1000 c.ft. to 1222 c.ft. (assuming inverse proportion), which will require an increase of pressure from 3 in. to 4½ in. Combining the two causes, the 3-in. pressure would have to be increased to 6 in. This is not taking into account the stipulation under the Gas Regulation Act in regard to the 2-in. minimum pressure, which only affects those undertakings or districts which have in this respect come short. Mr. Lacey has pointed out the extraordinary way in which during the last thirty years the same average size of main has served to convey an increasing output of gas—the increase being nearly double, over that period. This has come about by the spreading of the demand more evenly throughout the hours of the day and the days of the week. In fact, the maximum hour is by a most remarkable coincidence the same at the beginning and the end of the thirty years' period. On this the gas industry in its distribution department may well be congratulated; but with the advent of a lower-grade gas, an increase of main diameter would be required immediately, or a greater increase of pressure. With existing mains and the cost of opening roads, the latter is the only practicable recourse.

II.—*Longer Mains and Services.*

Housing schemes, with their garden city plans, wider areas, and longer distances, are taxing the capital accounts of gas undertakings, so that in many cases supply cannot be contemplated without a subsidy. High-pressure distribution requires less capital outlay by reason of the smaller mains. In place of capital expenditure, there is the added revenue cost of fuel (probably gas) for pumping, and a minimum of labour for attendance.

III.—*Capital Outlay.*

There is also the shortage of capital which must inevitably follow the great war; and this consideration must weight the choice of schemes on the side of revenue.

HIGH PRESSURE AND PURIFICATION.

This article is merely suggestive, and cannot be comprehensive of existing practices; nor can it enter into costs. As a matter of fact, no one likes getting-out costs at the present time. But there are several technical points that should be touched upon briefly. Trouble due to oxide deposits has been experienced by many undertakings with high-pressure installations. It has been one of those mysterious happenings similar to the deposition of naphthalene. The Life of Gas-Meters Committee have extended their operations and taken the matter in hand promptly and in good time, realizing that high-pressure distribution has come to stay. The result of their findings is recorded in the transactions of the Institution of Gas Engineers; and their chemist, Mr. J. G. Taplay, is still open to receive communications on the subject. The Helps system of compressing gas to 25 or 50 lbs. in cylinders, and then reducing to a lower pressure—perhaps 5 lbs.—for distribution in the mains, may or may not be financially economical; but it gets rid of the surplus water in the gas, and with the moisture come-down the corrosive compounds which, in a gas poor in benzole, &c., play so much havoc with mains, services, and meters. This purifying result may be brought about by a smaller margin in compression—that is to say, it would be well always to pump up the gas to at least a few pounds higher than the pressure required for transmission, and then to bring about condensation in cylinders, before expanding the gas into the mains. No receivers are required, and the mains can be laid without any regard to fall.

ELASTICITY OF HIGH-PRESSURE DISTRIBUTION.

No comparison of low-pressure and high-pressure distribution is complete without taking account of the elasticity of the latter. Once the mains are made sound and the compressing plant installed, pressures can be increased and the output augmented according to the demand.

SITE OF GAS-WORKS.

With complete distribution under higher mechanical pressure, it will no longer be necessary for a new undertaking to select a low-lying site for its gas-works. The ancient tenet of the gas engineer, which requires him to gain an inch or so of pressure by difference in levels, has been responsible for many a flooded retort-house.

COLLIERY PIPE-LINES.

On the subject of gasifying coal at the pit-head and transmitting long distances, the "Electrical Times," in its issue of July 1, 1915, contained an editorial under the heading "Pole Lines or Pipe Lines?" of which the following is an extract:

> "There is a colliery, says the hypothesis, fifty miles from a certain town, requiring light and heat. Would an all-gas or an all-electric scheme of transmission and distribution best serve the purpose? If a mixed system be preferable, how should it be proportioned? . . . Years ago we published an article on 'Pumping Petroleum *versus* Pumping Electricity,' and the writer of that article proved to his own satisfaction that there were conditions in which the oil pipe-line would easily beat the electric pole-line. We do not necessarily endorse his finding; but if it was true that oil could win in the special conditions cited, why should not gas? . . . That depends upon the gas engineer himself. He will not face high pressure on a big scale; he is defensive and conservative, an attitude which bids fair to cost him very dear. . . . He will only think in low pressure and big pipes. Were he boldly to adopt higher pressures than anything yet dreamt of in his philosophy, there might often be conditions in which he could help the generating and transmitting engineer over a stile."

An article appeared in the "Times Engineering Supplement" of November, 1919, entitled "Power Transmission by Gas—A Comparison with Electricity," from which the following extract is taken:

> "The potentialities of gas transmission being so enormous, it is strange that gas has not been considered as an alternative to electricity in connection with the vast schemes of power supply which have recently been brought forward. This omission is the more surprising when it is remembered that compressed air has long been used as a medium for the conveyance of power, and that something like 150 times as much energy can be transmitted by a gas-main as by the same pipe conveying air. The possibility of piping gas to long distances is hardly realized in this country, although in the United States it has for many years past been carried upwards of 200 miles in the case of natural gas, and 35 miles or more in that of coal gas."

CONCLUSION.

The gas industry is now fully awake on its manufacturing side, and in distribution it is rousing. There has been in the past too much rule-of-thumb in the latter department. The present tendency of the largest gas companies to appoint the scientifically trained man, to tackle the difficult pressure and other physical problems which are met with after the gas leaves the works, is a welcome sign. Such men will need to put into practice every ounce of their technical equipment, if gas is to keep pace with, and possibly outstrip, the march of other industries.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

A Further Big Cheque.

A further cheque for £885,368 has been paid to the Imperial Continental Gas Association, who last November received from the Enemy Debts Clearing Office a cheque for £4,740,527 on account of the proceeds of liquidation.

In a City note, last Thursday, the "Times" said: It is probable in the near future a further payment will be made to the Imperial Continental Gas Association in respect of its war claims. The payment will be on account of revenues earned in enemy countries during the war, and is expected to amount to about £850,000. Being in respect of revenue, it will be available for distribution, and will not, of course, in any way impair the Association's assets. It may be remembered that claims by the Association against Germany have already been satisfied to the extent of £4,971,000, out of which sum a dividend of 20 p.ct. (net) has been paid; and the payment of a further 60 p.ct. in respect of capital has been announced, and will be made in March. This 60 p.ct. is still being carried in the price of the Association's stock—namely, 122. The general position of the Imperial Continental Gas Association appears to be approximately as follows: Its capital outstanding, after allowing for the 60 p.ct. to be repaid, will amount to £2,000,000; and there will remain a liability in respect of 3½ p.ct. debenture stock, after allowing for the 65 p.ct. to be repaid, of £360,000. Against these sums, it possesses assets consisting of gas-works in Brussels, Antwerp, and Flushing, and an interest of £1,200,000 sterling nominal in the Paris Gas Company, besides which there are reserves amounting to upwards of £800,000.

GAS BILLS FOR 1921.

[THIRD ARTICLE.]

THE review of the Gas Bills that have been lodged for consideration in the coming session of Parliament is continued to-day.

The first promotion which would in the ordinary course have to be noticed on this occasion is that of the SOUTH METROPOLITAN GAS COMPANY; but as there was a special explanatory statement as to its provisions and objects in our issue for Dec. 29 [p. 762], there is no need to say more here than that its main provisions are to amend the capital powers of the Company. But as the special article showed, interest does not end there. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

The SPENBOROUGH DISTRICT COUNCIL gave notice of a Bill; but this has been converted to an application to the Board of Trade.

The ST. HELENS CORPORATION seek a revision of their maximum prices for gas. They propose that they shall not at any time exceed 6s. per 1000 c.ft. for gas supplied within the borough, and 6s. 6d. for gas supplied outside the borough. While seeking this power, opportunity is taken to obtain authorization to the purchase of secondary products from other gas undertakings up to a quantity equal to one-third part of the St. Helens production. Other clauses are of the usual character. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, & Co.*]

From the preamble of the SWANSEA GAS COMPANY'S Bill, we learn that the total authorized ordinary capital, including £52,200 added on conversion, is £522,000, whereof the Company have raised, including premiums, £380,894 13s., and there remains to be issued £141,105 7s. The Company are authorized to borrow on mortgage sums amounting in the whole to £156,662, of which there remains to be borrowed £95,066. The Company have also been compelled to borrow large sums from their bankers, which are being increased. Within the borough the maximum price was 3s. 6d. per 1000 c.ft., and outside 5s. But the Company had to take refuge under the Statutory Undertakings (Temporary Increase of Charges) Act; and they are now authorized to charge 6s. 2d. per 1000 c.ft. within the borough and within a distance of a mile beyond the boundary. The dividend the Company pay under the last-named Act is only 3¾ p.ct. per annum; and during the continuance of the Order, they are deprived of the right to pay arrears of dividends out of the reserve fund, which by law they were entitled to do. In consequence, the stockholders have sustained a loss amounting in the aggregate to a sum exceeding £11,000. The Company's business is rapidly enlarging; and considerable sums of additional capital are required, which it is impossible to raise except upon onerous terms. It is submitted in the preamble that the rate of interest or dividend on capital invested in industrial securities has materially increased in recent years; and it is therefore essential, in order to induce investors to purchase the capital, that the dividend the Company may pay should be commensurate with such increased rate. It is further submitted that—having regard to the loss sustained by the existing stockholders by reason of the diminution of the dividends and the deprivation of the right to make-up arrears out of the reserve fund, and to the fact that the large amount of capital which must now be raised (a considerable proportion of which will rank in priority to the existing ordinary capital) will still further depress the value of the existing ordinary capital—it is just and expedient that the rate of dividend paid on the existing ordinary capital should be increased. The clauses of the Bill are directed, in the first place, to establishing the heat-unit basis. Within six months after the passing of the Act, the Company are to declare the calorific value of the gas to be supplied by them. Revision of the calorific power is provided for, as well as the adjustment of the consumers' appliances. Adopting the provisions of section 2 of the Gas Regulation Act, there is a proviso that "the Company shall not be under the obligation to supply gas at the minimum permissible pressure defined in sub-section 4 of section 2 of the Act until a date to be fixed by the Board of Trade by Order under section 1 of the Act, and such Order may prescribe different minima of pressure for different parts of the limits of supply." The basic prices proposed are: "Within the borough, and within a distance of one mile of the boundary of the borough, 1s. 11¾d. for each standard unit. At a greater distance than one mile from the said borough boundary, 2s. 0¼d. for each standard unit; within the parish of Oystermouth, 2s. 3¾d. for each standard unit." The basic rates of dividend proposed are 6 p.ct. on capital already issued, and 8 p.ct. on capital issued after the passing of the Act. The Company have adopted the South Metropolitan Company's plan of dealing with profits made when the charges are below the basic price, with a difference in the total of the sum which may be divided between the proprietors and the employee co-partners. It is proposed that they shall be entitled, in equal shares, "to a sum equal in the whole to one-half of the total sum by which the consumers have benefited in such year or half year by way of a reduction in the price or prices of gas supplied to them below the basic price or prices." As to finance, the Company ask to be empowered to raise, in addition to any capital already authorized, £225,000. Regarding borrowing powers, the Company wish to be allowed to raise (in addition to the £61,600 already borrowed under the powers of their previous Acts or Orders) the sum of £199,400, and any sum or sums not exceeding in the whole half the amount of any capital (including premiums) authorized by the present measure. Debenture stock and redeemable preference and debenture stock powers are sought. Reserve and special purposes funds authorization in the modern form are included. A number of miscellaneous clauses follow. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The TENDRING HUNDRED WATER AND GAS COMPANY are promoting a Bill in which they are seeking an amendment of their financial powers. In an early clause it is provided that, notwithstanding anything to the contrary in section 56 of the Act of 1912, the Company shall not create or issue any more "A" or "B" shares; but they may from time to time raise £91,120 19s. 5d. (being the unissued portion of the additional capital of £120,000 which they are authorized to raise) by the creation and issue of new ordinary shares or new preference shares. The "A" shares would henceforth be called "preferred ordinary shares." Then the ordinary shares which immediately before the passing of the Act were called "B" shares, and any ordinary shares in the unissued additional capital authorized by the Act of 1912, which may be created and issued under the provisions of the Act, are henceforth to be called ordinary shares and new ordinary shares respectively. On this capital the Company desire the right to pay 10 p.ct. on the part issued as ordinary, and on the part issued as preference at such a rate as the Directors may determine, unless a larger dividend be at any time necessary to make up the deficiency of any previous dividends which shall have fallen short of the respective rates of dividend. As to borrowing powers, the Company name £52,500; being the amount necessary to increase the borrowing powers in respect of the capital to one-half its amount. In respect of preference and debenture stock powers, the Company desire the right to issue either class of stock as redeemable on such terms and conditions as may be expressed on the certificates. Annual meetings of the Company are arranged for. Part of the Bill refers to water supply; and then various other gas provisions follow. New works and the usual secondary products clauses appear. The Company are also proposing to transfer their operations to the therm system; and the clauses are in much the form of those already noticed. The price is put at 19·6d. per therm so long as the Company manufacture gas solely at their existing works in Walton-le-Soken, or 21·6d. per therm after they have commenced to manufacture gas on lands specified in the schedule to the Bill, situated at Kirby Cross. Regarding prepayment meter charges, for the hire of meter and fittings the charge of 2·2d. per therm is proposed, and 2·8d. per therm if a cooking-stove is included. The charge for the hire of a prepayment meter without fittings is placed at 1·4d. per therm, or at the rate of 10 p.ct. on cost, whichever may be the higher. [*Parliamentary Agents: Messrs. Torr, Durnford, & Co.*]

The THAMES DEEP WATER WHARF AND RAILWAY COMPANY are seeking power to construct a wharf and railways and other works in the county of Essex, and other objects. Clause 15 proposes that the provisions of sections 18 to 23 of the Railway Clauses Consolidation Act, 1845, shall for the purposes of the present measure extend and apply to the water and gas mains, pipes, and apparatus of any local authority, and shall be construed as if "local authority" were mentioned in these sections in addition to "company or society," provided that any penalties recovered under section 23 shall be appropriated to that fund of the local authority to which their revenues in respect of water and gas (as the case may be) are appropriated. A later section asks that the Company may, within the limits of the wharf works, supply gas and electric light and power for purposes connected with the wharf works, and for the use of vessels resorting thereto, and may make such reasonable charges therefor as they may from time to time order or direct. [*Parliamentary Agents: Messrs. Dyson, Bell, & Co.*]

A Duplex Gauge for Water-Gas Sets.

An instrument intended for the gauge-board of a water-gas set, and designed to replace the gauges ordinarily used for indicating the pressures in the set and wash-box, is being manufactured by the Connelly Iron Sponge Company, of New York. There are three pipe connections to the gauge—one from the generator ash-pan, one from above the fire in the generator, and one from the top of the wash-box or its gas-outlet. The gauge indicates simultaneously, by a black and red pointer concentrically mounted over a dial, two of these three pressures—viz., the ash-pan pressure at all times, and either the top of the generator or wash-box, depending upon which way a lever is turned that operates a three-way cock. The differential or drop through the fire can be read at a glance at any time during the blow by dropping the carburettor and superheater blast-valves, provided the three-way lever is in the proper position. During the run, the differential between the internal pressure in the set and the external pressure can be easily read. The gauge is operated by two steel U-tubes containing mercury. Iron floats are attached to steel racks which are properly guided, and mesh with concentric gears operating the concentric pointers. The advantages claimed are compactness, the elimination of a multiplicity of gauges with long glass tubes necessitated by the higher pressure now used, and the indication of helpful differentials, as well as direct pressures. No refilling is required, as the mercury will last indefinitely. A little oil is used on the surface of the mercury. Ample pressure range and depth of seal for ordinary operating conditions are provided.

ELECTRICITY SUPPLY MEMORANDA.

WHEN the Birmingham City Council cannot find money for their big schemes, including much required extensions at the Nechells electricity power station, then things have come to a pretty pass.

No Money.

But that is the condition; and it will remain the condition while the Government are wanting money, while big industrial concerns are offering high rates of interest and dividend for new capital, and while investors (who are also ratepayers) see the rates soaring up with prodigious strength (which is uncomfortable for their pockets), and not more than 6 p.ct. offered for money by municipal authorities. The Finance Committee have informed the Council that it is not possible at present to report that further capital is available or in sight beyond April 1 next. This is a bad position with schemes involving millions of capital in the programme of the Council; but it is a hard fact that has to be faced. With the financial outlook so uncompromising, the Finance Committee do not feel justified in undertaking to meet contracts other than those already let. The only chance of getting money would be to raise a loan in America, if the Government did not put their foot down, seeing that they may want to go to the same source. But an American loan for Birmingham would have to be at such a price that only extreme urgency would warrant it, in view of the burden it would be upon the schemes on which the money was expended. The Electricity Committee have made a strong appeal to be allowed to proceed with their extensions; and they point to 3500 applications that they have on their books for connections from all classes of present and would-be consumers, with the present plant working at full capacity. But the Finance Committee are firm in shutting-off the tap against new commitments, even in the interests of electricity and housing. The Council have turned a deaf ear to the appeal of the Electricity Committee, and an open one to the Finance Committee. For the time being, until fresh light falls upon the financial situation, there can be no extension of the electricity business. The Council have an outside counsellor. The "Electrician," in effect, tells the Council that they are adopting a policy of foolish economy; but it does not give the Council an opportunity of thanking it for a sane suggestion as to how it is to raise loans. The "Electrician," of course, knows better than the Council what is the right course to pursue; but it ought not to say unkind things about the policy of the Council without informing them how they can escape from their dilemma. We see that at Edinburgh electric plant that two years ago was estimated to cost £490,000 has risen to £633,000, which is nearly 30 p.ct. increase on the former estimate. Unfortunately, the plant will not produce more through costing more, seeing the advance is due to labour, materials, and transport.

No New Connections.

One of the serious aspects of the municipal administration of electricity supply undertakings, which are founded and operated on a highly technical basis, is that the last word has to be left to a number of men who know little or nothing about the matters upon which they have to give decisions. One often feels amused over the gross absurdities that are committed by some local governors whose estimate of their own abilities in determining technical matters far transcends that of those who are capable of submitting their proposals and decisions to examination from the technical point of view. We have been interested in a discussion that took place recently in the Hastings Town Council. It is not often that we have been able to congratulate the Hastings Corporation Electricity Committee; but we do over their recommendation that it will not in future be desirable for intending consumers of electric current to wire their premises previous to ascertaining from the Electrical Engineer whether the current required can be furnished. There were certain of the councillors who resented this proposal, and who seemed to think that the Committee were legally bound to supply if demand was made. The obligation to supply depends on circumstances. Undertakings are not compelled to supply fresh applicants, if they are not in a position to do so without jeopardizing the supply to existing consumers. If they supplied new consumers and old ones suffered in consequence, they would be guilty of maladministration. The law is supposed to be interpreted logically, and not in a senseless way. Whatever may be the legal position of new applicants as to receiving compliance with their demands, this must be subject to the ability to supply, and to the rights of existing consumers. Several concerns, without a margin of generating plant, have shut-off the making of new connections, supplying electric radiators, and so forth, much to the distress of the Electrical Development Association. But it is wise to refuse new obligations with which there cannot be compliance without reducing the ability to fulfil adequately the obligations already in hand.

Palliative Plant.

But the councillor thinks he is ingenious who suggests some temporary palliatives in these times. One Hastings councillor proposed that the Council should take steps to obtain and erect small temporary plant to take on additional power. A small plant of the kind would mean an enormous capital outlay in proportion to the old plant and output, and working efficiency would probably be lower; and thus the units generated by it would cost more. But the Committee would not be in the position to charge the extra costs to the new consumers to meet whose requirements this plant was put down, for the simple reason that the Committee are legally bound to supply all consumers taking a corresponding supply on equal terms. The temporary plant would mean an increased cost all round, or a further tax on the ratepayers; and goodness knows the Hastings ratepayers have, one way or the other, paid through their noses for their electricity supply. There was another councillor who stated that the suggestion as to the provision of a temporary station could only have been made by one who had no knowledge of the inside working of the Electricity Committee; but the councillor who said this testified to the extent of his own knowledge by stating that the money received for heat and power was "practically all profit." The present price for heating is 2½d. per unit, and 9¾d. for lighting. Heating at 2½d. is enormous, seeing that, if used at 100 p.ct. efficiency, only 3420 B.Th.U. would be obtained. With gas, 10 c.ft. used at 75 p.ct. efficiency would give more heat than that into a room; and the 10 c.ft. would only cost the hundredth part of the price charged per 1000 c.ft. With coal, used at 20 p.ct. efficiency, 1½ lbs. would give more heat to the room than the unit of electricity; and at £3 per ton the 1½ lbs. would only cost about ¼d. Fancy a 2-unit radiator costing 4½d. every hour run, or a 3-unit one 6¾d. However, the Hastings Council endorsed the view of the Electricity Committee, that it would be better not to have more connections at present rather than run any unnecessary risks with the present overcrowded plant.

Steam-Heating Supplies.

It is not likely that electrical engineers will hitch on to the rear of their undertakings white elephants in the way of a steam-heating system. As we recently showed, there are many objections to it (one of which is the want of coincidence between the heat and the electricity demands); and it might, instead of cheapening electricity generation, help to run up its cost. We lately quoted the information brought back from America by Mr. S. L. Pearce, the Chief Electrical Engineer of Manchester, that large schemes have been tried in America; but the opinion is general there that steam-heating supplies are best furnished from independent stations, and not by being combined with the production of electrical energy. It is not solely a question of thermal efficiency. Many practical and commercial considerations thrust themselves into the problem. Sir Dugald Clerk has written to the "Electrical Times" anent Mr. A. Hugh Seabrook's article in our contemporary on the subject, which article we alluded to in the "Memoranda" for Dec. 29. Sir Dugald is glad to find that Mr. Seabrook agrees with the conclusions at which he arrived in the "James Forrest Lecture on Coal Conservation." In his lecture Sir Dugald showed that, if electrical engineers desire to supply heat as well as light and power, it will be necessary for them to give up the idea of the large superstation, in which the maximum efficiency of turbine is aimed at and condensing water used to dispose of the heat of 80 p.ct. of the steam passing through the engine. In the lecture he came to the conclusion that it would be better to arrange non-condensing steam-turbines discharging steam at a temperature somewhat above 100° C., arranging the steam-turbine efficiency at about 10 p.ct., and utilizing the 70 p.ct. of heat of the steam still available for the distribution of heat. In his view this would have given a total efficiency of electric distribution and steam heating of 45 p.ct. This agrees practically with Mr. Seabrook's figure of 50 p.ct. Now Sir Dugald says that at present it is not probable station engineers will adopt this system; but in the future, when scarcity of coal imposes the necessity of rigid economy both in electric generating stations and in gas generating and distributing stations, all the devices which are possibly applicable will be applied to economize heat in order to minimize the fuel consumption for our great cities. That steam distribution from electricity generating stations will be one of the "devices" seems to be sinking to a lower station of improbability than ever before.

Main Costs and Housing Schemes.

The "Electrical Times" refers to the "encouraging tendency" which is being displayed at the present time in many of the housing schemes, of installing electric cooking and heating apparatus on a large scale. We are glad to see the "tendency" is encouraging. What would be still more encouraging for electrical men would be success, particularly on the "large scale." But success in installation would not necessarily mean success in giving satisfaction to the tenants of the dwellings built under the schemes. The statement precedes a lament regarding the cost of laying mains in connection with new housing schemes. The matter arises out of the intimation of the Brentford Gas Company last autumn to the Hammersmith Borough Council that they could not undertake the supply of gas to the houses to be erected under the housing scheme unless the Council consented to bear a proportion of the cost of laying the necessary mains. The Council were evidently a little piqued over this, and so asked the Electricity Committee to supply an estimate for furnishing electricity for cooking purposes to a block of forty or fifty houses for experimental purposes. We are not certain, but, from an estimate by the Finance Committee, it looks as though the necessary supplementary mains would cost about £11,250. The Gas Company asked the Council to bear a proportion of the cost of the gas-mains. They declined. The Council are now asking the London Housing Committee to get the support of the

Ministry of Health in obtaining the Government subsidy for the cables as part of the assisted housing scheme expenditure. Of course, it seems folly to exclude gas, water, and electric mains from the subsidy. But the folly (if such it really be) is the practice; and we do not suppose Hammersmith will secure its reversal. But there is something to be said for the Government attitude. It is not likely that the mains and cables will be for ever exclusively retained for the supply of electric current to houses erected under the housing schemes, but will later on be tapped for other supplies. The Government cannot therefore subsidize plant which is not, or may not be, solely applicable to the housing schemes. Apart from this point, the Hammersmith Electricity Committee do not appear to be in the position to give a prompt answer to the Council's inquiries as to the cost of the proposed experiment. They want to be allowed to make certain tentative arrangements of an experimental order, involving the purchasing and the hiring-out of electric cookers and heaters, and initially they ask for £200 for the purpose. Have the staff of the Department so little knowledge of these matters that they must, at this time of day, experiment before giving some guiding information to the Council? Perhaps, however, it is as well they should go to work tentatively, as there are not many of the prospective householders who will desire to be ruined by electrical operation, nor have their tempers spoilt by waste of time through dilatory performance and freakish supply.

POSITION OF NITRATE OF SODA.

WHILE admitting that a forecast to-day, in the present condition of the financial and industrial world, can hardly be of much value, Messrs. W. Montgomery & Co., Ltd., in their half-yearly nitrate of soda report, draw attention to one or two points that may be helpful. The Association of Producers have now adherents representing 97½ p.ct. of the production, who have bound themselves to observe the regulations until, at any rate, the beginning of 1924. This Association, it is thought, if properly managed, ought to make for steadier markets in the future. For the six months under review, deliveries in the United States were 159 p.ct. more than was the case in 1913; and but for financial and labour troubles, they would almost certainly have been much greater. That the European deliveries should have been 58 p.ct. less than in 1913 is in no way surprising.

Optimism prevailed during the months of July and August; and in view of the high price of sulphate, buyers were somewhat insistent in their purchases, both for near and distant delivery. But troubles of various kinds began to assert themselves; and the market in September had a tired appearance, as the result of resales at lower prices. About the middle of October, prompt f.o.b. was sold at 13s. 6d. per quintal, or 3s. below the Association price; and the close was nominally about 12s. 6d. Meantime, cargoes for this season's arrival had held their price fairly well at 23s. 6d. to 24s. c.i.f. United Kingdom, though by mid October this price was probably more nominal than real, as there was no business to test the market. The prospects of developments favourable to the market before the season came round determined the large holders not to sacrifice.

Stocks in Europe and Egypt, at 385,000 tons, are rather more than double those of last year; while the quantity afloat is about three times as much. Stocks in Chili are quite plentiful at 1,360,000 tons, but are less by 216,000 tons than in 1919, though nearly treble those of 1913. It is understood that the Association will adjust this situation by cessation or restriction of production. The production for the past twelve months amounted to about 2,475,000 tons, as against 1,626,800 tons in 1919, and 2,728,500 tons in 1913. Freights have been falling heavily; and since July there has been a continuous drop in the Chilian exchange. The consumption in the United Kingdom for the six months ended Dec. 31 is put at 31,000 tons in 1920, compared with 43,000 tons in 1913; the figures for the twelve months being respectively 73,000 tons and 124,000 tons. The consumption on the Continent during 1920 is given as 790,000 tons; and for 1913, 1,700,000 tons. The report states that the world's consumption for the twelve months ended Dec. 31 last was 2,348,000 tons; the total for the year 1913 having been 2,520,000 tons. The visible supply at Dec. 31 last (including the quantity afloat for Europe, and stock in the United Kingdom and on the Continent) was 753,000 tons.

At yesterday's meeting of the Institution of Petroleum Technologists, there was submitted a paper on the "Carbonization of Lubricating Oils," by Mr. S. H. Garner, of Mellon's Institute, Pittsburgh.

To-morrow [Thursday] evening, the Midland Junior Gas Association are to hold a meeting at which Mr. L. H. Thomas, of the Nechells Gas-Works, Birmingham, will read a paper entitled the "Application of Reinforced Concrete to General Gas-Works Practice."

A visit is to be paid next Saturday afternoon by members of the Scottish Junior Gas Association (Western District) to the Summerlee Iron Company's works at Coatbridge. On Saturday evening [Feb. 5] the Association meet in the Royal Technical College, Glasgow, to hear a paper by Mr. William Bennett, of Mossley, entitled "Thoughts on the Education and Training of a Gas Engineer."

YORKSHIRE JUNIOR GAS ASSOCIATION.

The members of the Yorkshire Junior Gas Association last Saturday afternoon visited the works of the Wakefield Gaslight Company at Vicarage Street, Wakefield, to inspect the steam-raising plant and hear a paper by Mr. H. L. Bateman (Assistant Manager) on the process adopted recently by the Company to raise steam more cheaply by the use of low-grade fuel that is otherwise difficult to dispose of. There was a large attendance.

VISIT TO THE WAKEFIELD GAS-WORKS.

The visitors were conducted round the plant by Mr. Bateman and members of the staff. In addition to the steam-raising plant and the ordinary gas-works plant, the visitors were interested in inspecting a 5-ton transport wagon which the Company use to convey coal to the works. The wagon is a "Sentinel" steam-vehicle, the only fuel for which is the Company's own gas coke. It has been running about a year and a half, and has cost less than £5 in repairs. Its use is economized by arranging to transport outward loads of coke for each inward load of coal. The vehicle has carried some 15,000 tons, running about 70 tons per eight hour day.

A subsequent meeting was held in the Board Room, presided over by the PRESIDENT of the Association (Mr. G. Dougill).

Mr. H. TOWNSEND, the Engineer and Manager of the works, said he was requested by the Directors to give a hearty welcome to the visitors. The Directors of the Company had a high regard for the Junior Gas Associations of the country, and felt that the Associations were doing excellent work. Speaking personally, he had always had a very warm corner in his heart for the Junior Associations; and he was delighted to see the useful work they were doing, and the excellent papers which were being put before the members. It had always been a project of his to find a use for the great amount of fine coke dust which was unfortunately produced by the conveyor; and in 1914 his son Harry, who was Assistant Engineer with him at Wakefield, was engaged in considering the question of finding a profitable use for the dust. He had taken a keen delight in the matter, and was looking forward with great interest to carrying it through. Unfortunately, the war intervened; and he and his brother both gave their useful lives to the service of the country. The war put a stop to the project for the time being. When Mr. Bateman became assistant, however, one of his first jobs was the carrying out of the scheme. He was glad to pay tribute to the enthusiasm, energy, and ability that Mr. Bateman had put into the work. The visitors had seen the plant that afternoon; and it promised well to achieve the end which had been in view.

The PRESIDENT expressed, on behalf of the members of the Association, their appreciation of the kind invitation and welcome of Mr. Townsend and the Directors of the Company. Steam, of course, was almost the life-blood of a gas-works; and cheap steam was an absolute necessity. Coupled with it there was the necessity for getting rid of low-grade fuel which was not readily saleable. For the Wakefield works to do something which achieved these two objects together was an achievement indeed.

Mr. BATEMAN submitted the following

DESCRIPTION OF THE PLANT.

The retort-house contains twelve beds of inclined retorts. The coal is fed into the retorts by gravity, and the coke withdrawn on to a De Brouwer hot-coke conveyor, where it is quenched. After this, the coke travels, by means of inclined and radial conveyors, to the reinforced concrete coke-storage hopper in the yard or to the coke-grading and smithy breeze plant, as desired. The coke conveyor provides for coke stacking in the yard if necessary.

The "K. and A." latest system of blue water gas plant is designed for an output of 50,000 c.ft. of water gas per hour, or a double gas of higher calorific value when this is desired. The operation of the plant is carried out by one man, who, by simply turning a wheel, operates all valves automatically. There are two 110-H.P. turbo blowers, each capable of supplying to the generators 25,000 c.ft. of air per minute at 24 in. pressure. These turbo blowers have proved to be very efficient and quiet in running. In conjunction with the water-gas plant is arranged an automatic fuel-elevating plant, by means of which it is possible for the water-gas operator from the operating stage to deal entirely with his own fuel, at the rate of 12 tons per hour.

Above the generators are provided reinforced concrete hoppers capable of storing 45 tons of fuel. By this means, an abundance of fuel is always in readiness for the generators, which are fed by gravity each hour. [Experiments on complete gasification of coal are now in progress, the results of which will be given at a later date.]

The relief holder has a capacity of 400,000 c.ft., the outlet of which is connected with the inlet of the coal-gas condensers, wherein the water gas and coal gas mix and pass through the usual purification apparatus. By this means the SO_3 contained in the crude water gas is neutralized in the ammonia scrubber, and a perfect blending of gases results.

The 500-H.P. boiler plant is constructed above ground level, and is of the water-tube type, fitted with chain-grate stokers, fuel elevators, forced-draught arrangements, and ash bunkers beneath

the boilers. The plant has been designed for the burning of low-grade fuels, and formed the subject of the paper read later.

The main purifiers are of Green's type, set below ground level and arranged for the downward flow of gas, with emergency valves provided to relieve back-pressure in the case of the upper surface of the oxide caking. These valves would be brought into action until the box could have convenient attention.

The tar plant is of the Hird continuous type, having a capacity of 5 tons per day. Storage tanks are provided for ample storage of dehydrated tar in preparation for the heavy demand during the summer months.

The two town gasholders each has a capacity of 600,000 c.ft. which, together with the water-gas relief holder, give a total storage of 1,600,000 c.ft. The Company supply a colliery, manufacturing, and industrial district by means of the usual trunk mains and 15 in. boosting mains.

Mr. BATEMAN, with the assistance of lantern slides and drawings round the room, then read his paper on

GAS-WORKS STEAM-RAISING AND THE USE OF LOW-GRADE FUELS.

The great disturbance which has occurred in fuel supplies, not only in Great Britain but also on the Continent, as a result of the war, has drawn still closer attention to the possibility of burning very low-grade fuels, which hitherto were considered unsuitable. The generation of steam for the manufacture of gas and the production of power on gas-works is of particular interest at the present time, for the following reasons:

1.—Economy of fuel from a national point of view and ultimate high thermal efficiency of gas-works practice.
2.—Utilization of low-grade fuels, consisting of coke dust, coke breeze, and pan breeze refuse resulting from the operation of gas-works apparatus.
3.—The Gas Regulation Act requires the manufacture and sale of gas on a strictly thermal basis. Economy in steam production, therefore, becomes of great importance.
4.—During the manufacture of water gas and the complete gasification of coal, the cost of fuel, maintenance, &c., and the resultant thermal and commercial efficiency of gas-works steam raising plant, has its final effect on the cost of gas into the holder.

In designing boiler plant for burning gas-works refuse, the first essential point is that the steam-raising plant shall be of a type suited to the conditions to be met both in regard to type of unit installed and general lay-out. The matter of lay-out is very important; and careful study of this factor will invariably be rewarded. Imperfect lay-out greatly increases labour costs, by necessitating more handling of fuel and ash than would otherwise be the case. Careful consideration should be given to the conditions under which the plant will operate, especially regarding maximum and minimum steam output, and the type of boilers and auxiliary equipment selected accordingly.

LANCASHIRE VERSUS WATER-TUBE BOILERS.

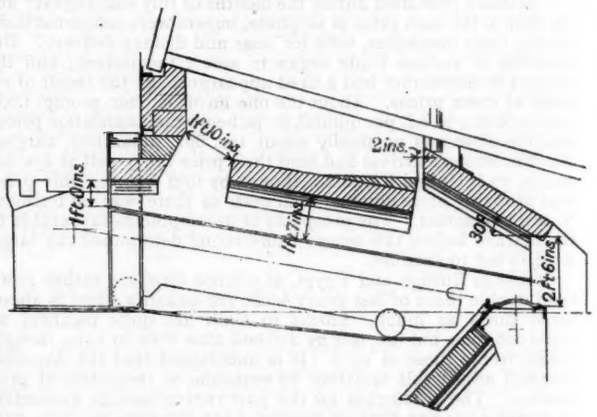
In regard to the boilers, choice lies between the Lancashire boiler and the water-tube types. The general question of their relative values opens-out a wide field which cannot more than briefly be dealt with here. Cylindrical boilers have the advantage of large steam and water spaces, and can thereby carry a good reserve of power. On the other hand, they occupy relatively large floor-space; and their furnaces must necessarily be limited in dimensions and scope of design. It is often the case in gas-works that much refuse is produced possessing fuel value to a greater or less extent; and while the use of such fuel would not usually be considered in the case of an ordinary steam-raising plant, it is often economical and convenient in gas-works to use such refuse fuel for steam raising, as it provides means for the partial disposal otherwise than paying for its removal from the works, though the ultimate incombustible of the refuse necessarily remains for disposal after it has passed through the boiler furnaces. It follows that the question of furnace design is of great importance in gas-works boilers where very low-grade fuels, containing more than half their weight of ash, moisture, and clinker, have to be burned. And in this direction cylindrical boilers admittedly lack the scope provided by some water-tube boilers. Further, cylindrical boilers are necessarily rigid in construction, and do not possess the flexibility and elasticity which the design of the water-tube boiler makes possible. On the other hand, Lancashire boilers are very easy to manage and control, and are more easily cleaned than those of the water-tube type. They are, moreover, much better for use where the feed water is dirty, greasy, or impure. Clean water is an imperative necessity for water-tube boilers; otherwise the tubes soon become choked with scaly deposit, and burn-out or burst.

With regard to water-tube boilers, their relatively small steam and water capacities do not enable any great reserve of power to be carried, although, against this, they undoubtedly possess far quicker steam-raising powers than a Lancashire boiler and, in general, the rate of steam production can be rapidly accelerated to meet the increased steam demands as they occur. Water-tube boilers are well adapted to forcing, and are not damaged by forcing to the same extent as Lancashire boilers, as the greater flexibility of the former can accommodate the increased expansion and contraction. The water circulation is also much quicker—indeed, the sluggish water circulation of cylindrical boilers, together with their restricted accommodation of expansion and contraction and their small furnace space, constitute their main defects. Water-tube boilers require more skilled supervision and operation than do Lancashire boilers. For a given steam capacity they occupy less floor-space, but more headroom, than Lancashire boilers. This becomes a factor of importance in relation to the mechanical handling of fuel and provision of ash-bunkers beneath the boilers.

An outstanding feature of the water-tube boiler is that it permits of the design of larger and better arranged furnaces than Lancashire boilers, and more perfect combustion should therefore be obtained with the water-tube boiler. This makes it in general more adaptable to the burning of very low-grade fuels. On the other hand, the initial cost of setting linings, baffles, and furnace brickwork generally is very much greater than is the case with Lancashire boilers, although renewals, repairs, and maintenance are correspondingly high. The steam production of a water-tube boiler is three to five times as much as that of a Lancashire boiler occupying the same floor-space; and it is a matter of consideration whether in some cases it may not be desirable to instal two or more boilers of relatively small capacity in order to attain the best thermal efficiency in operation.

It will be seen that there is much to be said for both types of boilers. The particular type selected should, therefore, be chosen in relation to all conditions under which the plant operates. In general steam-plant operation, the selection of fuel is a factor of primary importance; but, as already remarked, this matter is sometimes determined in gas-works by the necessity or desirability of burning the refuse coke dust and producer ashes. No boiler, however well designed and constructed, will operate efficiently if not properly worked and cared for. One of the most important essentials to the efficient working is a thoroughly reliable and intelligent fireman. But such men are, unfortunately, often difficult to find. When found, however, they are in every way worthy of appreciation.

In order to burn low-grade fuels, forced draught is an absolute necessity; and the type of furnace should be of such design that it is possible to instal a large grate area. The high percentage of incombustible matter and the cost of labour make it essential that, whatever type of furnace is installed, it must be self-cleaning. In this respect, I cannot do better than refer to the installation at these works.



Arrangement of Arches for a Stoker to Burn Coke Breeze.

The maximum area of combustion space in a Lancashire boiler is so limited that it is practically impossible to instal mechanical stokers giving sufficient grate and combustion area effectively to consume low-grade fuel and at the same time efficiently deal with large quantities of ash and clinker; but with water-tube boilers there are no restrictions as regards the size of mechanical stoker or grate area which can be installed. A number of systems of applying the mechanical chain-grate stoker for burning low-grade fuels are in use, most of which present disadvantages, especially regarding the ignition of low volatile low-grade fuels.

FORCED DRAUGHT.

The application of forced draught to chain-grate stokers is a very easy matter; and the design is such that, by making slight alterations in the side-frame castings, it is possible completely to box-in the ash-pit without in any way altering the original design of the standard chain-grate stoker or detracting from its special features of distinction. As the application of forced draught in this design requires only the simple boxing-in of the stoker-front and the ash-pit by suitable doors, and the installation of the necessary air-ducts, no detailed description is required.

The stokers are generally used on what is called the "balanced-draught system"—that is, sufficient pressure is maintained in the ash-pit to overcome the resistance of the fire-bed, and the suction draught at the damper is regulated to a degree which will just pull the gases through the boiler, so that the draught in the furnace is practically balanced. For normal conditions, the pressure in the ash-pit rarely exceeds 1 in. water-gauge, although, of course,

this can be increased to any pressure desired. With average fuel, however, ¼ in. to ½ in. water-gauge is usually sufficient. With this system, it is possible to burn qualities of low-grade fuel which previously presented some difficulty when only natural draught or induced draught was used. When average coal is used, forced draught is, of course, not necessary. By simply opening the front doors, the boiler plant can be operated by natural draught. With such facilities, it is therefore possible to adapt the stokers to the most economical draught conditions relative to the class of fuel used. The combustion chambers above the chain-grates are provided with a special arrangement of firebrick arches which serve to radiate the heat down upon the burning fuel and cause the flame to travel from the rear to the front of the boiler, thus causing early ignition of the fuel and a higher rate of combustion per square foot of grate area than in other systems; while the fuel is burned-down to complete ash and clinker as it passes beneath the arch at the rear portion of the grate.

The analysis of various low-grade fuels to be found on gas-works are as follows:

Coke Breeze (Poor Quality).

Size of fuel—			
Over ½ in. to ⅛ in.	40·60 p.ct.		
,, ⅛ in. ,, ¼ in.	25·10 ,,		
Under ⅛ in.	34·30 ,,		
Calorific value,	Dried fuel, 10,730		Undried, 8110
(Allowance is made for heat required to evaporate moisture.)			
Proximate analysis—			
Moisture	—	..	22·23
Volatile matter	5·90	..	4·59
Fixed carbon	70·80	..	55·06
Absolute ash	23·30	..	18·12

Ash-Pan Breeze. Coke and Clinker.

Size of fuel, ⅜ in. to 4 in.
Calorific value, dried, 4340; undried, 3807.
(Allowance has been made for heat required to evaporate water).

	P.Ct.		P.Ct.
Moisture	—	..	23·13
Volatile matter	0·68	..	0·62
Fixed carbon	31·45	..	24·15
Absolute ash	67·87	..	52·10
	100·00		100·00

Before fuels can be efficiently burned, together or separately, it is essential to have the ash-pan breeze crushed by suitable means to a size not larger than ¾ in. Careful attention must be given to the physical character and mixing of the fuel, as it is not advisable to allow the moisture content to be higher than 20 p.ct.; otherwise difficulty will be experienced in igniting the fuel within the combustion space of the boiler plant, with consequent loss of steam output. It is important to keep a plenum above the fires; and careful attention should be given to the formation of clinkers (where very dirty fuel is used) which are liable to cling to the firebrick sides of the combustion arches and upset the even fuel layers on the chain-grates—thus making air-pockets, and allowing cold air to cool the radiating arches, with the resultant effect of arresting temporarily the proper ignition of the fuel. This is overcome by the use of the clinker slice as often as is necessary.

With large steam outputs, and using very low-grade fuel, the amount of red-hot sulphurous ashes to be dealt with requires very careful consideration; and it is necessary to provide firebrick lined ash-hoppers of very strong construction, also good means for cooling and handling the refuse after passing out of the boiler plant. Details of a test carried out on a Babcock and Wilcox boiler with chain-grate stokers burning coke breeze, using forced draught, are as follows:

Babcock & Wilcox Boiler, of 4020 Sq.Ft. Heating Surface, fitted with Superheater of 1210 Sq.Ft., and Balanced Draught Chain-Stoker of 96 Sq.Ft. Grate Area (Low Volatile Brickwork Setting).

SUMMARY OF RESULTS.

Duration of test	5 hours.
Fuel.	
Name and class	Coke breeze.
Size—	Per Cent.
1½ in. to ½ in.	21·60
½ in. to ¼ in.	32·80
¼ in. to ⅛ in.	20·70
⅛ in. to 0 in.	24 90
	100·00
Analysis—	
Moisture	15·40
Volatile matter	3·30
Fixed carbon	61·50
Absolute ash	19·80
	100·00
Calorific value as fixed	9,186 B.Th.U.
Total quantity fired	15,125 lbs.
Consumed per hour	3,025 lbs.
Consumed per sq. ft. of grate per hour	31·5 lbs.
Ash and clinker	3·194 lbs. = 21·1 p.ct.
Steam.	
Average gauge pressure	184 lbs.
Saturated temperature	381° Fahr.
Superheated temperature	673° ,,
Degree of superheat	292° ,,
Water.	
Temperature entering boiler	132° Fahr.
Total quantity evaporated, actual	86·460 lbs.
Average evaporation, actual	17,292 ,,
Equivalent evaporation per hour, from and at 212° Fahr.	22,410 ,,
Evaporation per sq. ft. of heating surface from and at 212° Fahr.	5·570 ,,
Evaporation per lb. of fuel, actual	5·716 ,,
Evaporation per lb. of fuel from and at 212° Fahr.	7·408 ,,
Factor of evaporation	1·296
Draught.	
Kind Used.	Balanced
Suction at rear of boiler	0·2 in.
Pressure in ashpit	0·86 ,,
Flue Gases.	
Temperature leaving boiler	559° Fahr.
CO_2 at boiler outlet	11·6 p.ct.
O ,, ,, ,,	9·0 ,,
CO ,, ,, ,,	*Nil*
Efficiency.	
Boiler with superheater and stoker	78·28 p.ct.

PULVERIZED FUEL.

Pulverized fuel is again receiving very close attention in this country. This method of burning coal is, of course, not new. As a matter of fact, it has been tried on different systems in Europe during the last 25 years; but hitherto no system has achieved sufficient prominence to become really a commercial success. In America, however, this method of burning fuel has greatly extended, and modern plants give very promising results. Even there the success of pulverized fuel has been more confined to heating furnaces, &c., than to its application for steam-raising. Modern installations are now in operation in England; and it may be found that for some very low-grade fuels this system is the most efficient. But against this it must be remembered that the burning of low-grade fuels on mechanical stokers has greatly advanced of recent years; and considering that it is possible to consume efficiently some fuels containing up to 30 p.ct. or more of ash, it remains to be seen whether it is still commercially possible to use such fuel on the pulverized system, bearing in mind the cost of grinding and drying. Again, it is not yet established that low volatile fuels can be efficiently dealt with in the pulverized form; and for the class likely to be used on gas-works, the mechanical stoker at the moment appears to offer the best commercial solution—*i.e.*, when installed under boilers having sufficient combustion space.

MECHANICAL FUEL AND ASH HANDLING PLANT.

The modern fuel and ash handling plant has been adapted to feed boiler plants with fuel and remove the ashes and clinker. Referring to the installation at the Wakefield works, the fuel is stored in an underground pit; and a small 6 ton per hour elevator raises it, when desired, to feed the chain-grate stoker hoppers. This elevator is easily brought into operation by the boilerman at a moment's notice. In some installations, this type of elevator is entirely automatic in action—starting itself when fuel is required and stopping when the stoker hoppers are full. The rate of elevating the fuel is therefore easily and exactly regulated to the actual quantity which the boilers are consuming. The old type of chain and bucket elevator, the buckets of which are filled by dragging through the body of fuel, need only be noted as costly and liable to frequent breakdown in consequence of the bucket drag. This is now effectively superseded by the improved types, in which the buckets are automatically filled at the feeding end of the elevator.

The advantages of automatic elevator fuel-feed to boilers may be summarized as follows:

1.—The elevator cannot overfeed the stoker hoppers.
2.—When the hoppers are full, the elevator stops running, thereby reducing wear and tear.
3.—The need for close supervision of the boilerman is eliminated. The man can thus give greater attention to the burning of the fuel.

The question of ash-handling becomes of great importance when using low-grade fuels. It will be noted that the ashes and clinker leave the boiler plant in a red-hot condition. In the case of small plants, up to 500 H.P., the best arrangement appears to be the provision of a soundly constructed ash hopper beneath the boilers in which the ashes "deaden," after which they are discharged into suitable trucks for disposal. On very large plants use is made of suction ash-plants, which remove the ashes and clinker automatically into an overhead hopper after the clinkers have been broken-up. The plant consists of an exhauster, foul-air cleaner, and ash receiver. Pipe lines are required for conveying the ashes and clinker to the bunker for disposal.

DISCUSSION.

The PRESIDENT said they certainly could not over-emphasize the importance of cheap steam, and they could not over-emphasize the points made by Mr. Bateman, and think any one plant was a cure for everything. There were numerous claimants to be a cure. All of them had their good points; but there were faults to be found. He did not think any pulverized fuel company would guarantee to pulverize the material they had been considering and do it perfectly.

Mr. A. R. KNIGHT (Bradford Chemical Works) asked Mr. Bateman if he could give the meeting any idea of what had been done with ordinary Lancashire boilers with this pulverized breeze.

Mr. BATEMAN said he believed that before he came to Wakefield a great deal of work was done there to try to burn this material with the use of the existing Lancashire boilers; but from the reports he had heard, the stuff simply put the fire out. The material would not keep alight unless it had radiated heat falling on to it. Coke breeze, of course, could be burned in a Lancashire boiler by means of a Bennis compressed air grate; and if it was poor quality breeze, they would probably find that the steam was down or else that the men went home. [Laughter.] He would not like to try to burn it and make steam with it in a Lancashire boiler.

Mr. KNIGHT said he really believed it was largely a matter of suitable fire-bars, providing the fuel was, at any rate, fairly reasonable and steady. If they got fuel with 20 p.ct. of moisture, of course, they would, no doubt, have difficulty.

Mr. BATEMAN said in raising steam for a gas-works of the size of that at Wakefield, where they required evaporation of roughly 1400 gallons of water per hour on the top load, they could not keep opening the doors to clean-out the fires. They could burn the stuff; but they had to get the heat inside to the water. He believed it had been tried at Wakefield, but it had not been a success.

Mr. TOWNSEND said at Wakefield they had been using coke breeze ever since he came there, twenty-five years ago. When it was the ordinary coke breeze, they had no trouble with Lancashire boilers. They started with compressed air and breeze of 2 in. by 3 in. down to dust. As time went on, they had a great demand for smithy breeze, and put up plant for this purpose. Finally they got down to dust. In the meantime, they had adopted the steam-induced air blower; and they could use the ordinary coke breeze very well with it. When they got down to dust, labour soon began to kick. It certainly was an exhausting job; and finally the labour difficulty made them abandon it. They then had a great accumulation of coke dust on the works, and he did his utmost to find an outlet for it. As a matter of fact, he found five different outlets; but they only lasted a very short time—he believed the greatest period was six months. So they were faced with the accumulation of a tremendous heap of coke dust far finer than the breeze. They then considered the question of turning it into steam by using water-tube boilers. Bearing in mind the present labour situation, they had taken two fundamental principles into account in designing and constructing the plant. The first was simplicity, because complication was a most serious thing in dealing with the labour situation. The next point was in making mechanical appliances supersede severe manual labour. They had put in a plant which would deal with their low-grade fuel—the lowest grade fuel, he thought, that anybody had attempted to use. On the average, it was not even ¼ in. diameter. They had had this plant going six or seven weeks now; and so far the indications were very encouraging. They were hoping they would be able to burn all the great heap of dust, which had been exposed to the weather for some years, and turn it into steam. Fuel was such a great price now, and the cost of transport was so great, that if they could not turn this material into steam and had it to cart away, there would be a very great expense. The present inerts in coal, which had got into the dust, had accentuated the difficulties of the problem very materially. If the coal was as it had been before the war, without so much of this inert and extraneous material in it, the problem would have been much more simple. So far, at any rate, their progress in the undertaking had been very encouraging.

The PRESIDENT asked if Mr. Bateman could give the members of the Association any idea of the periods before the plant eventually required cleaning.

Mr. BATEMAN replied that the question of scaling depended mainly on the amount of water evaporated and the quality of the water. In the Babcock and Wilcox boiler, provided it was not forced, the dirt found its way to the mud drum; and if this was blown-out periodically, there was no reason why there should be any trouble. In cleaning, it was necessary to pay particular attention to the two bottom rows of water-circulating tubes. He understood the bottom tubes at Wakefield were capable of running for three or four years without renewal. Particular attention should be given to avoiding leaks. There was no reason to expect trouble if they did not neglect the plant. With low-grade fuels, the dust was a trouble; and the tubes had to be cleaned once a fortnight by blowing steam on to them to remove the dust off the tubes.

Mr. CHARLES ROPER (Bradford), referring to the labour question, said a case occurred at a works in which he was concerned where they had only one small boiler and burned coke breeze using forced draught, though it was not such poor fuel as that under consideration. They were not always on the spot, especially at night; and so long as there was coke to be had, there was coke going in. It was one of the difficulties present on every gas-works, and anything done to show where this poor fuel could be burned without excessive manual labour was a great advantage, even if it meant some capital expenditure. There was a very great leakage in real fuel, apart from the ordinary breeze or dust.

Mr. E. J. SUTCLIFFE, proposing a vote of thanks to Mr. Bateman, and also to Mr. Townsend and the Directors of the Wakefield Gaslight Company, said all of them that day must have received some profit in knowledge from their visit. In the matter of labour saving, in these days of the high price of money, it did not seem to have struck many people that it would pay to spend £2000 on labour-saving machinery in order to economize one man. The interest, at (say) 10 p.ct., would be £200 per year; and this was less than the money most of them were paying for a labourer to-day. The breeze problem had cropped-up largely in recent years because of its difficulties in steam-boilers, and also because of the lack of quality of the coal they had had to use during the past few years.

Mr. R. N. WEBB (New Wortley), in seconding, said the visit and the paper had been a pleasure and an education. They were not all blessed with having a boiler of the description mentioned. Mechanical handling of coke did crush it up very much, particularly the drag type of conveyor. Since they had the toluol plant erected at his works, their boiler capacity (Lancashire boilers) had been greatly tested; but it was serving its purpose. He believed that they would be able to use their material more economically if they had a boiler of the type described that day. It was certainly a more scientific boiler. The fact of the radiation of heat back by the arch over the grate must of necessity increase effectiveness.

Mr. TOWNSEND and Mr. BATEMAN briefly responded.

THE VISITORS AT TEA.

The visitors then had tea, as the guests of the Directors of the Wakefield Gaslight Company.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

On Saturday last, members of the Association (Eastern) visited the Markinch Gas-Works and the Rothes Paper Mills; there being a good attendance. The party were conveyed by motor to the paper mills, round which Mr. Summers conducted them. They found much to interest them in the boiler plant and the electrical installation. The paper-making process was lucidly described by the guide. The party were then conveyed to the Markinch Gas-Works, where they were welcomed by Mr. J. Allan, the Secretary. After an inspection of the tidy little works, conducted by Mr. H. Gourlay (the Manager), they proceeded to the Masonic Hall, where the Markinch Gas Company entertained them to high tea.

Subsequently the President (Mr. D. Campbell) said he wished to convey the thanks of the Association to Mr. Gourlay and Mr. Summers for their services during the afternoon. Though the visit to the paper mills was a thing apart from the gas profession, Mr. Summers had made their time one of great interest and instruction; and he asked the members to accord Mr. Gourlay and Mr. Summers a hearty vote of thanks. Mr. Summers replied, and said he hoped the members had benefited more by their visit than he had lost by it.

EXPERIENCE WITH A TULLY PLANT.

The members then discussed the paper read lately by Mr. Henry Rule [see "JOURNAL," Dec. 22, p. 704].

Mr. W. A. DEARDEN (Dunfermline) opened the discussion by asking Mr. Rule as to the method he employed for varying the speed of the gas engine which was employed to drive the blower-fan, and which was slowed-down during the gas-making period.

Mr. RULE replied that this was done at present by merely checking the gas supply; but as this method tended to give an incorrect mixture to the cylinder, he contemplated fixing a device by means of which the speed would be easily variable at the governor.

Mr. MORTON (Kirkcaldy) asked Mr. Rule if he had experienced any buckling of the top cover of his plant.

Mr. RULE said that he had not experienced this trouble, as his top cover was strengthened by two pieces of railway metal.

Mr. DEARDEN called attention to a paragraph referring to the testing of the gas for CO_2, and remarked that, providing the apparatus was available, it would be advisable to test at least once a day, in preference to once a week, as suggested by Mr. Rule.

Mr. RULE agreed that the oftener the gas was tested the better; but when he compiled his notes, he did not wish to convey the impression that it was necessary to test as often as Mr. Dearden suggested, though tests were taken at his works daily.

Mr. AIR (Crossgates) questioned Mr. Rule as to the starting-up of his plant in the morning, after being bottled-up overnight.

Mr. RULE replied that he experienced no great difficulty; the method described in his paper being the one he always adopted.

Mr. MACKIE (Bo'ness) raised a point in connection with the CO_2 content of the gas.

Mr. RULE replied by stating that he found it was not economical to attempt to work with a CO_2 figure below about 6 p.ct.

Mr. MACKIE then asked Mr. Rule as to his experiences with the mixed water gas and straight coal gas in the district, and what pressure he found was required.

Mr. RULE replied that he was unable to supply a sufficiently high pressure to allow him to bring his mixed gas below 470 B.Th.U. His distributary system was supplying 43,000,000 c.ft., whereas at one time it was only supplying 20,000,000 c.ft.; and he was at present laying a feeder main to augment the supply in certain districts. When this was finished, he would have to experiment to find out how far he could reduce quality and still give satisfaction to the consumers. He could, however, say that since the installation of the Tully plant he had been able to supply a very regular quality of gas, which was a difficult matter before.

The PRESIDENT thanked those who had taken part in the discussion, and asked the meeting to accord Mr. Rule a hearty vote of thanks for his contribution.

Mr. RULE remarked on the knowledge to be gained by writing a paper, and said that if only members would realize this the President would be overwhelmed with offers of papers. What he thought the Association should do was to have two or three short papers at each meeting on a variety of subjects. This would give everybody a chance to contribute. He strongly appealed to them to adopt this suggestion.

"B.C.G.A." Vice-Presidents.—A welcome is extended in the "Bulletin" of the British Commercial Gas Association to the newly-elected Vice-Presidents—Mr. W. Doig Gibb, Mr. A. Proctor (Chairman of the York Gas Company), Alderman G. Walker (Chairman of the Bradford Corporation Gas Department), and Alderman J. Perkins (Chairman of the Oldham Corporation Gas Department). Regret is at the same time recorded at losing the services of Councillor J. H. Barraclough (Bradford) and Alderman H. J. Wilde (Oldham), who have recently retired from their respective Gas Committees. The General Committee have already sent appreciatory letters to these two gentlemen for their past services to the Association.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The "Caloriscope."

SIR,—As the result of continued work, we have arrived at the conclusion that the instrument recently described in the columns of the "JOURNAL" [Dec. 1, p. 511] cannot be recommended for determining the calorific value of gases other than straight coal gas.

South Metropolitan Gas Company,
Old Kent Road, S.E., Jan 13, 1921.

E. V. EVANS,
Chief Chemist.

SIR,—I note with interest your comments upon the "Caloriscope," devised by the engineers of the South Metropolitan Gas Company, and described in your issue of Dec. 1 as having been presented before the recent meeting of the Southern Association of Gas Engineers. What really brings forth this communication is not the abstract of Mr. E. V. Evans's paper describing his apparatus, which is indeed very interesting, but your editorial comment as follows: "Where Mr. Brady failed to apply this knowledge to a gas calorific value indicator," &c.

This statement is not consistent with the fact that you previously published [Dec. 16, 1919, p. 608] a very complete description of the theory, together with a description of our instrument (which, by the way, is called a "B.Th.U. Indicator"), and that we are now having difficulty in meeting the demand for them.

The knowledge of the fact that the application of this principle or idea will enable us accurately to determine heating value is gratifying and sufficient; but we should not overlook the incidental fact that the gas manufacturer in using the instrument need not go so far as to read the heating value. If he keeps the gas that is being made of such a quality that the determinations fall upon the part of the scale which experience shows him to be satisfactory, he knows that uniformity in the heating value is being achieved, and in addition that the consumers' appliances are continuing to give satisfactory flames because the phenomenon in the Indicator is exactly the same as that in the burners of the appliances. The Indicator is less liable to give erroneous readings than the Flow Calorimeter, because there are fewer chances for error or negligence on the part of the operator. If the Indicator is properly supplied with gas and air, the indication of the flame is bound to be correct.

There are theoretical considerations which lead me to believe that the relation in question is not the empirical thing that we at first thought it was, and that the constants of the equation have a sound basis in physical theory. The Flow Calorimeter cannot, of course, be dispensed with; but it is my personal opinion that the day is not far distant when instruments such as our B.Th.U. Indicator, and others based on the same principle perhaps, will give more reliable results than the more elaborate Flow Calorimeters, as they are now ordinarily operated by the smaller works' operators.

It is, therefore, a pleasure to know that the research men of the South Metropolitan Gas Company are making use of this principle; and if they can devise an apparatus surpassing the B.Th.U. Indicator in utter simplicity, ease of operation, and reliability of results, all well and good.

The existence of such a relation calls attention to the almost virgin field for physical research in the gas business.

E. J. BRADY,
Physical Laboratory, United Gas Improvement Company.

Philadelphia, Pa., U.S.A., Dec. 15, 1920.

Sutton Gas Company.

SIR,—I notice in the "JOURNAL" of the 12th inst. a communication from Mr. H. E. Jones with copy of his letter to me of Dec. 16 last. This being a reply to mine, I did not consider an answer necessary.

Mr. Jones rashly assumes that his arguments for a transfer of the Sutton Company to the Wandsworth Company are unanswerable. There is every reason to believe that the majority of the Sutton shareholders and consumers are strongly opposed to Mr. Jones's one-sided proposals.

I have already placed on record my objections to the proposed transfer; and as the question at issue has now been referred to an influential representative Committee of stockholders, it appears to me undesirable at this juncture further to discuss the matter. I am prepared to wait the result of the Committee's investigation.

The Gables, Derby, Jan. 15, 1921.

J. FERGUSON BELL.

SIR,—I had not noticed in your editorial that you called attention to the fact that for two years Sutton appears to have charged no more than the Wandsworth Company. Now, as the price of gas at Sutton from 1912 to 1918 had been from 10d. to 14d. above Wandsworth, as is natural, you may be reminded that the Chairman told us at the meeting that deferred repairs of £18,000 had accumulated, which sum spread over the two years in question equals 7½d. per 1000 c.ft. for each of these years.

Moreover, no capital was spent on improving the mains (very badly needed); so the plight the poor manager is in, to keep going, is a woeful one indeed. It is only accomplished by means which will stand no sort of comparison with the ordinary state of manufacture elsewhere. It would be well, therefore, to avoid contrasts which are not vouched on the true facts and conditions, however plausibly they may be put forward. The fact is, the Company have been driven by the war into the ditch; and the way out will mean very costly extensions indeed, unless other sources can be tapped, as offered by this amalgamation.

Poor Mr. Drew was anxious as to the therm price to be fixed, independently of the amalgamation, and taking into account the "undeferred repairs," arrived at such a large figure that he strongly urged that the figure proposed in the amalgamation, of 14·68d., should be got rather than apply for 19d. or so, which is the lowest figure either he or I could work the concern for alone, with the high coal cost and the bad state of the mains. It will be interesting to see Mr. Bell working out his salvation on a lower therm price than that applied for by the Wandsworth Company.

But surely all your readers know that "Sea Power" has put my old Wandsworth works far away ahead of any Suburban company. The enclosed table of Board of Trade applications proves my case, showing that none other proposes within the equivalent of 8d. to 10d. per 1000 c.ft. of the Wandsworth Company. Indeed, they can't do it.

13, *Queen Anne's Gate, S.W., Jan. 17, 1921.*

HY. E. JONES.

Board of Trade Applications.

	Pence per Therm.
Gas Light and Coke	15·6
Commercial	15·6
Wimbledon	14·68 to 15·2
Croydon	19·0 ,, 19·8
South Suburban	17·0 ,, 20·0 West Kent
Tottenham	19·0
Brentford	19·0
Lea Bridge	19·0
Uxbridge	19·4
Slough	20·0 ,, 21
Plymouth	14 6 ,, 17·2
Derby	14·0 ,, 15·6

Meter Capacities.

SIR,—I note, in your issue of the 12th inst., in the report of the visit of the members of the London and Southern District Junior Gas Association to Messrs. Parkinson & Cowan's works at Cottage Lane, Mr. W. W. Parkinson infers "that by increasing the capacity per revolution of the meter, the life is reduced, and that engineers will soon be complaining of the short life of their meters."

I wish to say that I quite agree with him, if certain types of diaphragms are used; but I would ask him the simple question whether he wishes to argue that a three-light meter containing scientifically constructed and manufactured diaphragms and fittings, and making 800,000 less movements of the leather in recording 100,000 c.ft. of gas, will have a longer or shorter life?

Kennington Park Road, S.E., Jan. 12, 1921.

E. W. SMITH, *Managing Director.*
Smith Meters, Ltd.

Gas-Furnaces.

SIR,—With further reference to Mr. M'Isaac's paper to the Scottish Junior Gas Association (Western District), and his letter appearing in your issue of the 5th inst., I am afraid Mr. M'Isaac has somewhat misunderstood the spirit of my letter appearing in your columns on Dec. 22. It was merely intended to add yet another suggestion to those that have been made from time to time with regard to the classification of furnaces, as I think it is generally agreed that at the present time the basis of comparison is not a satisfactory one.

I was very interested to read Mr. M'Isaac's suggestion to classify furnaces under the three headings mentioned by him; and I feel sure he does not intentionally take exception to my making further suggestions on this subject. After all, both Mr. M'Isaac's and my own classifications are only suggestions; and Mr. M'Isaac is undoubtedly correct in stating that the decision in this connection rests neither with him nor with myself, but must be determined by the general opinion of those interested in the matter.

I think, however, it will be agreed that in classifying furnaces under various headings, it is desirable that such a method should be adopted as will give some indication of the relative value in efficiency of the furnaces—particularly to users. Probably, the most convincing classification to Mr. M'Isaac would be—"good, bad, and useless;" and it is with a view to a classification somewhat on these lines that I wrote my December letter, giving briefly the reasons for the suggested classification. I hope others interested in the matter will express their opinions on the subject; so that the outcome may be some generally accepted classification of furnaces under headings which will indicate some idea of their relative value and efficiencies.

Mr. M'Isaac makes reference in his letter to the use of automatic gas and air controllers. I quite agree with him that such appliances, capable of satisfactorily performing the functions they are designed to carry out, would be a distinct advantage in many furnace installations. But I am sorry to say that up to the present the various appliances of this sort which I have tested have all proved to be a much greater bugbear than the attention entailed in running furnaces without them. Many of them are incorrect in design, and it is obvious, without troubling to test them, that they will fail; while others are mechanically incorrect and only perform their functions over a very narrow range of gas consumptions. All such devices that I have yet had to deal with omit to take into account the most important factor of all in maintaining a correct relationship between the gas and air—namely, variation in the quality of gas supplied.

The relative proportions of gas and air required will obviously vary with the quality of the gas; but, strange to say, in none of the automatic controllers which I have so far encountered has this vital consideration been taken into account.

WALTER R. TWIGG, Technical Manager,
Davis Furnace Company.

Luton, Jan. 11, 1921.

After considering an application by the men employed at their gas-works for an increase in wages of 5s. per week and pay for Sundays, the Ellesmere Urban District Council have granted an increase of 5s. for a seven-day week, bringing the wages of stokers up to 55s.

REGISTER OF PATENTS.

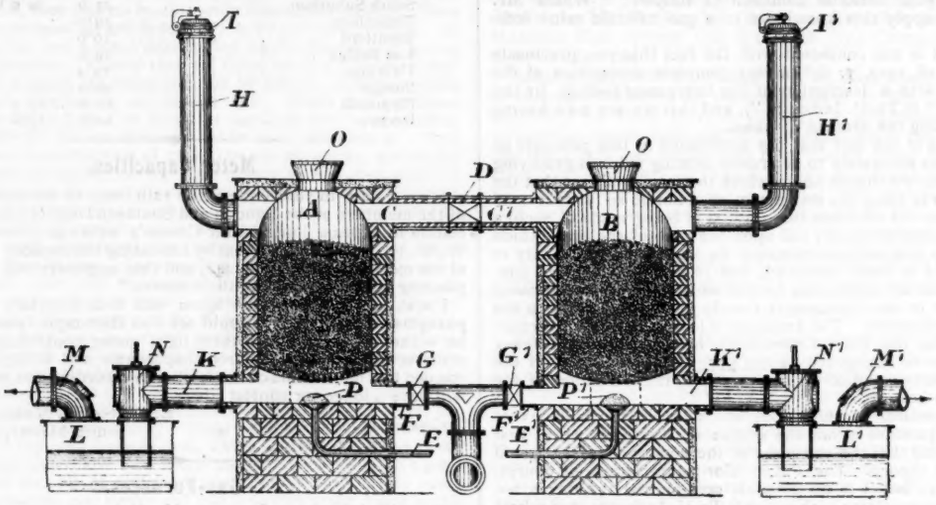
Water-Gas Producers.—No. 139,451.

RINCKER, F. G. C., of Middenweg, Holland.

No. 22,785; Sept. 16, 1919. Convention date, Feb. 24, 1919.

The process according to this invention consists in raising a charge of coke in one generator to incandescence, while allowing the evolved gas to escape; closing the outlet flues for the evolved gas, and blowing steam through the incandescent charge of coke in the generator; then passing the evolved water gas and other gases direct to, and through, a second generator to effect the distillation of a charge of solid fuel therein; then raising or blowing the coke-charge produced in the second generator to incandescence; blowing steam therethrough; and then passing the evolved water-gas direct into the first generator to effect the distillation of a fresh charge of solid fuel therein. The process is thus reversible.

In the illustration, A and B are two generators, which are reversed alternately in operation; C, C¹ are passages connecting the generators



Rincker's Water-Gas Producer.

with each other at the upper ends. D is a valve disposed between the passages to prevent the escape of gases from one generator to the other during the hot blast—the valve being open when the evolved water gas flows to the other generator. E, E¹ are conduits at the lower part of the generators for the purpose of admitting steam for the generation of water gas. F, F¹ are pipes for the supply of air to the generators. They are provided with cut-off valves G, G¹. H, H¹ are flues for the escape of the products of combustion from the upper part of the generators. They are provided with closing covers I, I¹, used to close the flues when the generator in which the water gas is being generated attains the required temperature. K, K¹ are pipes which lead the evolved gas mixture to the receiver L or L¹, according to the direction in which the plant is being operated. The gas mixture escapes thence to the purifying plant and the gasholders. N, N¹ are valves which serve to lead the evolved gas-mixture to the receivers or to confine it in accordance with the direction of working. O, O¹ are openings through which fresh quantities of fuel or gasifiable material are alternately fed to the generators; and P, P¹ are doors through which the waste material can be removed.

The method of operation is as follows: Assuming the operation commenced with the generator A, the latter is charged with coke, while at the same time the other generator B is filled with any suitable solid fuel, from which the gas can be generated. If it be desired to obtain coal gas and its bye-products, the generator B is charged with coal. If the gas from brown coal or lignite be desired, the generator is charged accordingly. The coke-charged generator A is thereafter heated in the usual manner and raised to the desired temperature—air being admitted to the generator A by the pipe F.

During the whole period of operation of the air-blast, the valve D remains closed in order to prevent the flow of the products of combustion to the generator B. The evolved gas escapes by the flue H, either to the atmosphere or for heating or other purposes. As soon as the coke in the generator A acquires the desired temperature, steam is admitted by the pipe E, and the gas-period for the production of water-gas begins. The air admission pipe F to the generator A is then closed. Simultaneously, the cover J of the flue H is closed in order to prevent the escape of the water gas generated, and the valve in the passage or conduit C is opened, in order to allow the produced water-gas to flow to the generator B. Simultaneously therewith, the cock N¹ is opened to allow the nascent mixture of gases to escape through the outlet to the receiver L¹.

The water gas produced in the generator A now flows through the valve D to the generator B, and this gas-evolution period continues as long as satisfactory water gas is evolved in the generator A. The volume of water gas produced in the generator possesses an average temperature of about 1000° C. By bringiug this volume of highly heated water gas into contact with the gasifiable mass (coal, brown coal or lignite, peat, wood, wood waste, and the like) contained in the cold or non-heated condition in the generator B, gases are produced therein from the known materials. These gases are led from the generator B by the pipe K¹, through the valve N¹, to the receiver L¹, and thence, by the pipe M¹, to the purifying plant, and then to the gasholders.

Simultaneously therewith, the gasifiable material in the generator B is converted into coke, which serves for the production of water gas when working the plant in the reverse direction.

When the charge of coke in the generator A has decreased to such an extent that the yield of water gas therein is considered insufficient, the direction of working is reversed. For this purpose the valve N¹ is closed to the flue H¹, and the cover of the flue H¹ is opened. The valve G¹ of the air-inlet conduit F¹ is opened, and the valve D between the passages C C¹ is closed.

The coke-charge in the generator B resulting from the preceding gaseous movement (at a temperature of about 800° C.) is now heated to the required temperature by the introduction of air for the production of water gas; the products being allowed to escape. This is effected by the admission of air through the inlet pipe F¹ and through the valve G¹ built into the air-pipe. Thereafter the coke in the generator B is raised to the required temperature, and steam is supplied to the generator B through the pipe E¹; and there then commences a flow of gas. As soon as the temperature required for the formation and the flow of gas is reached, the cover of the flue H¹ and the cock G¹ of the air blast pipe F¹ are closed; while the valve D and the valve N, co-operating with the generator A, are opened. The water gas evolved in the generator B is now led to the generator A, which is previously charged with gasifiable material, such as coal, lignite, peat, wood, wood-waste; and there thus ensues on the one hand the conversion of the material into a kind of coke which in the succeeding working period is used again for the production of water gas. On the other hand, a mixture of water gas and coal gas is produced, which is led to the receiver L through the pipe K and the valve N; the gas in the receiver passing to the purifying plant by the pipe M and thence to the gasholder. This method of operation may be repeated as often as desired.

The technical and economic advantages effected by the invention are claimed as follows: First, gasification is effected by direct action of the evolved water gas on the solid material to be gasified, and not by indirect heating. Second, the considerable loss of heat consequent on the removal of the incandescent coke from the retorts and cooling with water is avoided. A further advantage consists in avoiding the loss of the heat which had to be employed for re-heating the coke that had to be removed from the stove and reintroduced into the generator for producing water-gas. Also there is no crumbling of the coke; and, accordingly, no loss of coke material takes place.

Carburetting Lighting and Heating Gas.

No. 153,045.

PERDRISAT, C., of Geneva.

No. 15,899; June 24, 1919.

According to this invention, the apparatus (through which the gas must normally bubble through a predetermined column of carburetting liquid) comprises a hermetically closed vessel, a gas inlet pipe reaching nearly to the bottom of the vessel, and a hermetically closed storage vessel connected to the first vessel by a pipe whose lower end terminates above that of the gas inlet pipe; the connecting pipe being provided with a valve constantly tending to close, but retained automatically open when a filling aperture on the second vessel is closed by a stopper.

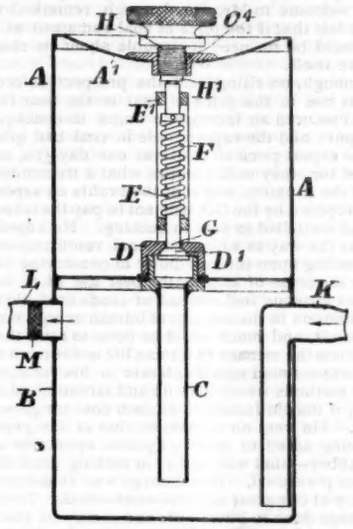
The illustration is a vertical axial section through the apparatus. A and B are superposed vessels communicating with each other by a tube C, of which the upper end leads into a box D containing a valve D¹ whose rod E is acted on by a spring F, which tends to maintain the valve closed. The rod is guided by a stirrup E¹ fixed to the box. Above the rod is a screw stopper H which passes through the cover A¹ of the vessel, and whose lower end H¹ presses against the upper end of the rod when the screw stopper is turned in one direction; but when it is turned in the other direction the rod is lifted by the action of the spring.

The valve D¹ has for its object to close the top of the tube C when the vessel is being filled—to effect which the screw stopper is com-

pletely removed. When it is replaced and screwed home to close the opening O^4 formed in the cover A^1, the valve D^1 is simultaneously opened, so that liquid in A flows into B through the pipe C. The flow ceases as soon as its level rises to the lower end of the tube; and the flow recommences as soon as evaporation lowers its level below the lower end of the tube.

The vessel B is provided with an inlet pipe K connected to a source of gas, and terminating a little distance from the bottom of the vessel. An outlet L for the treated gas is connected to a gas distributing pipe, and is provided with a metal grid M, which serves to filter the carburetted gas and prevent the striking-back of the flame.

The apparatus operates as follows: The vessel being full of (say) benzene, the valve D^1 is opened by screwing the screw stopper H home. The liquid then accumulates at the bottom of the vessel B



Perdrisat's Gas Carburettor.

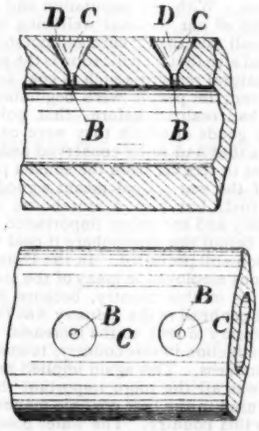
until reaching the lower end of the tube C, so that gas passing in through the tube K bubbles through the liquid and becomes saturated before escaping through the outlet L. The column of liquid through which the gas bubbles is equal to the difference between the levels of the lower end of the tubes C and K, and therefore remains constant.

Gas-Burners of the Bunsen Type.—No. 155,464.

PATERSON, E., of Croydon, and AULT, H. E. E., of Thornton Heath, Surrey.

No. 1008; Jan. 12, 1920.

This invention relates to perforated tube gas-burners of the bunsen type "an improved form of jet aperture which . . . ensures a more equal size of flame at each jet aperture when several such apertures are provided along the tube."



Paterson and Ault's Perforated Tube Gas-Heating Burners.

The section and plan of a portion of a tube according to this invention is given. Each jet aperture in the tube comprises a narrow cylindrical part B, a conical or expanding part C, and a shallow or short cylindrical part D. The walls of the tube are sufficiently thick to "enable these parts to be formed distinctly and well defined." When the combustible mixture is issuing through one of the apertures and the jet ignited, combustion commences at the neck between the parts C and D or at the larger end of the coned part C. The part B (being in the nature of a constriction) throttles the rate of flow of the combustible mixture therethrough. When the jet has been lighted a sufficient time to heat the tube, the mixture, after expanding as it passes out of the part B into the part C, is preheated by contact with the walls of the conical part before it is ignited at the upper end. The part D serves to arrest the outward flow or further expansion of the gases which have travelled upwardly within the coned part C, so that a longer and thinner column of flame is obtained.

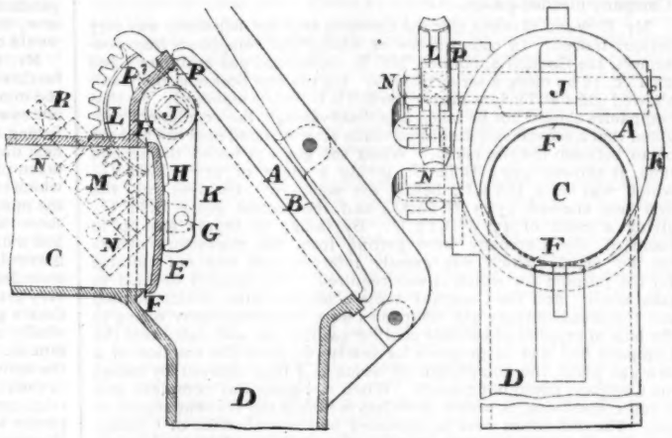
With this arrangement of jet apertures, flames of equal size are said to be obtained at each jet along a tube of considerable length having a number of such apertures formed in it.

Off-Take Pipes of Gas-Retorts.—No. 155,401.

GOODALL, CLAYTON, & CO., LTD., and ARCHDALE, J. A., of Leeds.

No. 24,318; Dec. 6, 1919.

This invention relates to valve and inspection devices for the off-take pipes of gas-retorts, with the object of providing a valve which shall



Archdale's (Goodall, Clayton, & Co.) Retort Off-Take Pipe.

permit of free passage of gas from the retort to the hydraulic main without the usual liability to clogging-up with tar and the like, and which at the same time shall permit of free inspection and access to the off-take pipe. At the same time it serves (when charging) as an anti-dip connection between the off-take pipe and the hydraulic main.

A longitudinal section of the valve is given, and inspection devices for the off-take pipes of gas-retorts and the like; also a front elevation of the arrangement, but with the valve and inspection lid, and the operating worm, omitted.

A is an ordinary elbow inspection opening with a hinged lid B, fitted at the junction between the off-take pipe C and dip-pipe D. The off-take pipe is fitted with a terminal disc-valve E having a knife-edge seating F. The valve hinges at G upon an arm H mounted upon, and moving integrally with, a shaft J at the upper end of the inspection elbow K, and carrying control gear consisting of a toothed wheel segment L meshing with a worm M mounted in a bearing bracket N conveniently attached to the casting of the inspection elbow. An indicator lug or finger P, also fitted upon the shaft J operating in conjunction with a diaphragm on the elbow casting, shows the position of the valve when open or shut—the valve working within the inspection elbow, which is enlarged for the purpose.

The control mechanism is operated by a key lever (not shown) fitted upon a square R of the worm which, upon being rotated, moves the worm, segmental wheel L, arm H, and valve E, integrally from the closed position first shown to the open position which will be apparent, when the lug P attains the position of the lug P^1, and *vice versa*.

Hereford Gas Supply.—The Hereford City Council have accepted the explanation of the Gas Committee regarding a breakdown on Christmas Eve, and have also approved of the Committee's decision to increase by 50 p.ct. the rents of meters and cookers, as from last September quarter. Regarding the breakdown, Alderman Witts (the Chairman of the Committee) said it was unlikely that in the future there would be a recurrence, as this would be obviated by the new gasholder, which it was expected would be completed in a month. Mr. Andrews voiced a complaint of many residents in the Ledbury Ward, as to public lamps in several streets being alight till mid-day, one day just before Christmas, and asked for an explanation. He added that the waste that took place was bound to have aggravated the shortage of gas at the works which was felt so keenly on Christmas Day. Alderman Witts replied that this must have been due to a pure accident—most probably to the failure of the pressure wave in the particular district.

Matlock Gas Prices.—At a meeting of the Matlock Bath District Council last Friday, the Clerk reported that the only opposition to the Council's application for power to increase the price of gas to a maximum of 7s. per 1000 c.ft., if necessary, was from the Cromford Parish Council, who were opposing because a firm who made enormous profits were, they alleged, paying less for gas than the net cost price. It was stated that in 1913 the Council made a contract with the firm in question to supply gas at 1s. 6d. per 1000 c.ft., but that this had been increased by concessions from the firm to 3s. 10d. per 1000 c.ft. Now the firm hold that they should only pay the ordinary consumers' advance. During a discussion, Mr. Lennox referred to a decision in the High Court on the point, where it was held that to sell below cost broke the contract. There was, however, a probability of an appeal on the point; and he thought they should wait. It was ultimately decided to ask the Cromford Parish Council for substantiation of their statements to the Board of Trade.

LEGAL INTELLIGENCE.

EAST GRINSTEAD GAS COMPANY SUMMONED.

Deficient Calorific Power.

On Saturday, at the East Grinstead Police Court, two summonses were heard which had been issued by the local Council against the East Grinstead Gas and Water Company, for having supplied gas on Dec. 18 and 23 of a calorific power of less than 500 B.Th.U.—to wit 417·1 and 437 9 B.Th.U. respectively—contrary to the provisions of the East Grinstead (Standard of Calorific Power) Order of 1919. The Company pleaded guilty.

Mr. ROWAND HARKER (for the Council) said the deficiency was very serious indeed. In consequence of widespread complaints from consumers, the Council appointed Mr. R. Grimwood gas examiner; and on Dec. 18 he made a series of tests. On the first occasion, the result showed 408·1 B.Th.U.—nearly 100 B.Th.U. below standard. So that companies should not be taken at a disadvantage, the regulations provided that a second test should be made after a stated interval, and the mean between the two taken. When the gas was tested the second time, it showed 429·4 B.Th.U., giving a mean of 417·1 B.Th.U., which was 82·9 B.Th.U. below the standard. On Dec. 23, the first test showed 433·3 B.Th.U., and the second 442·4 B.Th.U., giving a mean of 437·9 B.Th.U. By failing to supply gas up to standard, the Company were getting from the consumers money for an article which was grossly inferior, and was not suitable for the purpose for which it was required. The Council decided to take action; and the Company wrote a lengthy letter, which pointed out the disadvantages gas companies were labouring under owing to the lack of supplies of suitable coal for gas making, and stated that the Company had had in progress for nearly two years the erection of a new gas plant, the completion of which had been delayed by causes the Company could not control. When this plant was complete, and in full commission, it would doubtless facilitate the efficient supply of gas. The difficulties were accentuated by the coal strike of October last. The Company had only 320 tons of coal delivered during November and December; while their consumption was 1000 tons. The balance had been taken from war stock, which was of inferior quality. The Company had studied the national demands as required by the Government Department in economizing the use of coal; but they also studied the interests of the consumers, as the price of gas was 15 to 25 p.ct. lower than some neighbouring gas companies. The letter further said: "It follows as a matter of course that any action of your Council in enforcing the full statutory quality of the gas must necessarily advance the price, and the saving to the consumers would be wiped-out; and it would also compel the Company to take advantage of the Gas Regulation Act, 1920, by making an early application to the Board of Trade for a new Order, whereby the statutory quality of the gas may be reduced and brought into line with present-day general practice of gas supply." The Council, Mr. Rowand Harker said, had to assist in protecting the consumers; and the Company practically suggested that they should lay their heads together to neglect their statutory duties. Very rightly, the Clerk of the Council replied that, on the instructions of the Chairman, he had placed the letter before the Chairman of the Gas and Water Committee; and as the summonses had been already served, he did not feel justified in calling a special Council meeting.

Mr. F. S. WHITE (on behalf of the Company) said the offences were entirely beyond the Company's control. The Directors had been landed in that position by their desire to study the interests of the country. At the same time, the interests of the consumers had not escaped their notice. The bad supply of coal had caused them an enormous amount of trouble and anxiety. The reason why the gas had not come up to the statutory standard of quality was the shortage and the quality of the coal which had been supplied. During the war, the Company were encouraged to put down such plant as would recover the bye-products used in making munitions. When these were not wanted, there was a continual cry by the Government to economize the use of coal. The Company had to depend upon what was allowed by the Coal Committee. It was always considered that gas companies should have at least five weeks' supply of coal in hand to be safe. It was known there was going to be a coal strike; and the gas companies were greatly restricted in their supply. The effect of the strike did not disappear on the day when the miners went back. The Company's normal consumption was 500 tons per month; and they did not have sufficient coal to produce the gas required. Had they used it to make gas of 500 B.Th.U., they would have exhausted their stock, and there would have been no gas at all. This was the position of the Company. They were entirely at the mercy of the Coal Committee as to the amount of coal allowed them. It was a question, not so much of heat or illuminating power, as of pressure. The pressure had been bad. Referring to the letter, he said it was written before the summonses were served. It fairly set-out the facts. It told the Council the position. They had 200 tons of coal. Were they to use sufficient coal to force-up the gas to 500 B.Th.U., and eventually leave the town in darkness, or were they to do their best in exceptional circumstances? What was the good of the prosecution? He submitted that if a conference had been arranged, the Council would have understood the position better; and there would have been no need for legal action. The Company had decided to lay down new plant at a cost of £4000. The contract started in April, 1919, and was to have been finished in September of that year, but was not completed yet The difficulties were well known. The Company had not raised their price for gas, because they recognized that they could not supply gas of the proper power; and until they could do so, they would not charge more. He submitted that the Company had done their best in the very difficult circumstances.

The Magistrates considered that the Company should be fined 20 guineas, with 15 guineas costs, in each case. The fines and costs together amounted to £73 10s.

MISCELLANEOUS NEWS.

CONSERVATION OF OUR COAL RESOURCES.

The City of London Tradesmen's Club—an influential body no less than two centuries old, who have their meetings in the Cannon Street Hotel—had an informative and animated debate last Thursday evening, when they were addressed by Mr. F. W. Goodenough, Controller of the Sales Department of the Gas Light and Coke Company, on the subject of the "Conservation of our Coal Resources." A large gathering was presided over by Mr. Henry Maguire, who, in extending a cordial welcome to Mr. Goodenough, remarked that, speaking personally, he felt that if the price of coal remained as high as it was now, there would be no need to trouble about its conservation. It would conserve itself.

Mr. Goodenough, on rising, said the prospect before them was a further serious rise in the price of coal in the near future, because the miners had secured an increase in wages in consequence of their increased output; and the export trade in coal had greatly slumped. Seeing that the export price of coke was one day £10, and almost the next day £4 per ton, they would realize what a tremendous change had taken place in the situation, and that the profits on export coal, out of which it was proposed by the Government to pay the increased wages of the miners, had dwindled to next to nothing. He hoped to be able to show them that the way in which our coal resources were employed had a direct bearing upon the possibility of conserving human energy, particularly in the sense of making the best use of it, because by the extended use of gaseous fuel instead of crude coal, there could be a very great diminution in the amount of human energy required to produce a given result, and much could be done to raise the standard of vitality and reduce the menace to human life under town-dwelling conditions. No business man would tolerate in his factory or his office the antiquated methods which his wife and servants had to put up with in their homes, if the old-fashioned kitchen coal-range was allowed to reign supreme. He went on to mention that at the present time the people were being asked to spend £250,000 upon the restoration of Westminster Abbey—that was to say, in making good damage which could have been prevented. This damage was evidence of prolonged and gross misuse of our great national asset—coal. There was a huge amount of damage done to human life and energy by this same misuse of coal, which could, and should, be prevented. With the acumen which always characterized the Scot, James VI. of Scotland, when he came to take the throne of this country as James I., inquired when he reached London what was the cause of the darkness. Upon being told it was due to the coal-fires, he issued the same day an edict against their use.

Next the lecturer proceeded to point out the important part played by the fuel question in connection with the fertility of land; through the production of sulphate of ammonia as a consequence of the carbonization of coal. Besides being one of the most valuable and active artificial fertilizers, it possessed the advantage of a home-produced article, in contradistinction to the nitrates, which had to be imported from abroad. It must not be forgotten, too, that the land itself was unable to support the whole of the population of this country, and that we were compelled, and always would be compelled, if we were to remain the same-sized nation as at present, to import a certain amount of food from abroad; and upon our coal output, and upon the manufactured goods in the production of which coal was used, we depended very largely for the purchase of food from abroad.

In fact, the coal problem bore upon our national wellbeing in almost every direction. With the population and the fertility of the land, the great pillars of our national wellbeing were coal, iron, and steel. It had been well said that "corn and potatoes, coal and iron—these are power," and also that "civilization is the economy of power." The importance of natural resources such as coal and iron were to-day more evident than ever; for people were beginning to realize—what comparatively few had realized before—that gold and paper were nothing without the goods of which they were only tokens. It was our natural resources that had to be conserved and made the best use of, if the country was to recover from the shaken position in which it stood as the result of the war. Coal meant a good many things. It was not merely a fuel, but also a storehouse of chemical compounds of great variety and enormous importance, which were either consumed or sent to befoul the atmosphere if coal was burned in the barbaric fashion which still prevailed. In the United States, the output per head of persons employed in many of the staple industries was three times as great as in this country, because the horse-power of machinery employed per head in the industry was three times as much as here. It was necessary to look to the increased use of mechanical power to increase production in this country, to enable us to re-establish our financial soundness. This again implied an increased use of coal. Therefore it was all the more important that the coal which was used should be used in the best possible manner. There was no alternative to coal in this country. The water-power available was a mere nothing in comparison with the amount required; attempts to use peat on a commercial scale in place of coal had all failed, because of the cost and physical difficulty of separating the moisture from the combustible matter; no natural sources of oil had been revealed; and it was no use to talk of wood.

It was, declared Mr. Goodenough, coal or nothing for us. We had been warned about our diminishing stores of coal for the past sixty years or more; but, when people heard that we had still enough coal to last 600 years, according to the present rate of consumption, they merely turned over and went to sleep again. They forgot that it was not only a question of the coal there was, but of the cost of getting it. And when the position in regard to coal in this country was compared with that in America and Germany, material was provided which gave ample food for thought. According to all the estimates, there was unmined in this country at present something less than 200,000 million tons. This was a big figure; but when they found that in the United States there were 4,000,000 million tons (or twenty times as much), in

Canada 1,000,000 million tons (or five times as much), and in Germany 415,000 million tons (or more than twice as much), and that our usage in this country was fully half the annual usage in the United States, and nearly double the usage in Germany, they began to realize that it might not be long before it would be difficult in this country to compete in price with the more easily won coal of America. As a matter of fact, European ports were at the present moment full of ships laden with American coal. As our shafts got deeper, and our coal-seams thinner, the cost of producing a ton of coal naturally rose.

What, Mr. Goodenough went on to ask, was the best way in which we could, in the true sense of the word, conserve our coal resources? The answer he gave to his own question was that to the fullest possible extent we should distil the coal in the gas-works, rather than burn the crude material in grates and under boilers and furnaces. This would bring about the economy of human energy and transport and the preservation of chemicals; and it would secure an improvement of the atmosphere and in the public health. It would produce a material saving in the cost of house building. These were obvious national advantages, and obvious communal advantages; but was it to the interest of the individual to use gaseous fuel instead of solid fuel in industry and in his home? After all, if it was impossible to prove to the individual that it was to his advantage, it would take a long time to persuade him to subordinate his individual interests to the interests of himself as a member of the nation or community. Therefore, if they were going to advocate the use of smokeless fuel in gaseous form, they had to prove that it was to the advantage of the individual to do so. In how many cases it was to his advantage, the lecturer proceeded to show his hearers. Though there was, he said, undoubtedly a wide field for the use of electricity for light and power, there was absolutely no case for its use as a fuel. On the other hand, the uses to which gas was being put for industrial purposes were almost countless. It was being employed more and more wherever heat was required; and it was not too much to say that there was no industrial process to-day which could not be carried out efficiently by the use of either gas or coke. Coke was the alternative where prolonged and constant firing was needed. Its use in electricity generating stations was growing rapidly. An actual saving was effected; and there was the added advantage from a national point of view that no smoke was produced.

In conclusion, he said that the case he had tried to put before the meeting was that our supplies of coal were relatively small, though actually large; that they would become, and were becoming, relatively dear; that this would mean the loss, if they were not careful, of the neutral markets, and the loss of one means of buying food. Economy of production, so that the cost of coal might fall, was absolutely essential, and would, he was sure, be much more likely to be brought about when Government control was removed from the coal industry. Finally, there must be wisdom and economy in the use of the coal that we possessed. Carbonization, *plus* economy in mining, was the solution of the difficulty.

GAS FUND CONTRIBUTION.

Publication has been made, under date of Jan. 13, of the following Order of the Board of Trade, under section 7 of the Gas Regulation Act, 1920, prescribing the rate of contributions to the Gas Fund for the year 1921.

In pursuance of the powers conferred upon them by section 7 of the Gas Regulation Act, 1920, the Board of Trade hereby prescribe that:

1.—The rate of contribution to the Gas Fund for the year 1921 shall be three shillings for each million cubic feet of gas sold during the year 1920.

2.—Such contribution shall, on or before April 1, 1921, be paid to the Board of Trade at Great George Street, London, S.W. 1, by any gas undertakers with respect to whom an Order under the said Act shall have been made, by cheque made payable to the "Assistant Secretary for Finance, Board of Trade," and crossed "Gas Fund Account."

PROCEDURE GOVERNING BILLS INVOLVING CHARGES.

At the end of last November, there was appointed a Select Committee to consider the procedure governing Bills, whether public or private, involving charges (actual or potential) upon the rates, and to report what improvements can be made with a view to securing greater control of the expenditure of public money. The Chairman was Sir Donald Maclean.

In their report, the Committee divide the Bills which may involve charges upon the rates into four classes, each of which is considered separately. One of these is ordinary Private Bills, with regard to which they say it cannot be denied that a very substantial protection is given to the ratepayers by the Borough Funds Acts and kindred enactments, as well as by the Standing Orders of both Houses of Parliament. Ratepayers, however, by their own apathy, do not benefit by these safeguards as they should; and to arouse them to a livelier interest, the Committee adopt a suggestion that the notices of the Bill prior to the statutory meeting under the Borough Funds Act should contain a statement showing the financial effect of the passing of the Bill. They recommend that the Standing Orders should be amended so that the notice must include an estimate of the charges, both capital and annual, which would be laid upon the ratepayers, as well as the cost of promoting the Bill. They further recommend that, if at the statutory public meeting there are present, and opposed to a Bill, not less than twenty electors, and if subsequently a petition against the Bill is presented by one hundred electors, or one-twentieth in number of the electors, whichever may be the less, this minority shall be eligible for *locus standi* against a Bill promoted under the common seal of the local authority concerned. If, by such a petition, the Bill, or a portion of it, is rejected by the Committee to whom the Bill is referred, the successful petitioners may, it is suggested, be awarded taxed costs of their opposition from the promoters; while, similarly, taxed costs might be awarded against unsuccessful petitioners. These are the only changes which the Committee recommend in procedure with regard to Private Bills involving charges upon the rates. The question of the heavy and growing charges imposed upon local authorities by administrative regulations issued under the authority of various departments was considered to be of great importance, and well worthy of careful investigation. It was, however, deemed to be outside the reference to the Committee.

The Committee heard evidence on two days; the witnesses including Sir Aubrey Symonds, K.C.B. (a Permanent Secretary at the Ministry of Health). He said, dealing with Private Bills, that control to some extent was given to ratepayers by the Borough Funds Acts. The resolution for the promotion of the Bill was required to be passed by an absolute majority of the whole number of the Council, at a meeting held after ten clear days' notice by advertising in a local newspaper; and this resolution must be published twice, when it was passed, in a local paper, and must be again confirmed by a further resolution passed by a similar majority, after a similar notice, at a meeting held within fourteen days after the deposit of the Bill. This ensured that the promotion of the Bill would not be got through the Council without full and adequate notice. Then the Borough Funds Acts also required the consent of the local government electors. The local authority had to give notice, by placard and advertisement in two successive weeks in a local newspaper, of their intention to promote the Bill; and the notice must state various particulars—the title of the Bill, a brief statement of its objects, the date of the deposit of the Bill in Parliament—and say that copies of the Bill might be inspected and purchased, and that a public meeting of the electors would be held, not less than 14 or more than 28 days after the date of the first publication of the notice, for the purpose of considering the question of the promotion of the Bill. At the meeting, the Bill had to be explained; and then there could be a single resolution in favour of the Bill, or it could be taken in parts or clauses. There was a case quite recently in Birmingham where a Bill was promoted by the Corporation, and a particular clause rejected by the electors. The electors themselves, or the local authority, could demand a poll.

As to amendment of this procedure, witness said that, while the notice for the meeting had to include a statement of the general objects of the Bill, it was not expressly provided that this notice should contain an estimate of the probable expenditure. It had therefore occurred to him that possibly, with a view to securing greater control by the local electors, the Borough Funds Acts might be amended so as to require that the public notice of the meeting should include a statement of the estimated expenditure, both capital and annual, which the provisions of the Bill would involve. Further, that at the meeting of electors the explanation given should also include a statement of the estimated expenditure. The promotion of a Private Bill by a local authority required the approval of the Minister of Health; but the Ministry of Health, following the practice of the Local Government Board, had found it exceedingly difficult, if not impossible, to use this power as a means of preventing the promotion of Bills. It had been felt that it was not really proper for a Government Department to intervene between a local authority and Parliament; and neither the Local Government Board nor the Ministry of Health had, except on very rare occasions, done so. When they had, it was on such grounds that all the objects sought by the Bill could be secured by means of a Provisional Order. When the Bill was before the House, the parliamentary procedure, of course, was governed by the Standing Orders. Under these, the estimates now required to be given were, in effect, estimates of capital expenditure; and it might, if thought fit, be laid down that estimates should also be furnished as to the annual charges on the rates involved, not only by the permanent works, but also by any other proposals of the Bill involving charges. He understood, however, that the Local Legislation Committee did, in fact, require more detailed estimates than were provided for by the Standing Orders, and that they went as a rule very thoroughly into the financial position.

In reply to questions by members of the Committee, witness said he agreed that in many cases the estimate figures must be very largely conjectural; but he suggested that it was a matter for the Committee to consider whether it was not, on the whole, better to ask for a conjecture than to leave the thing absolutely in the dark, without giving the ratepayers any sort or kind of indication of the probable cost to the rates. The ratepayers should not shelter themselves, so to speak, behind the possibilities of parliamentary control. It was up to them, in the first instance, to look after their own rates. If there was any yielding to the temptation to put the estimates too low, they could be challenged.

Irish Gas Prices.—The Board of Trade have intimated to the Waterford Corporation that they have issued an Order fixing the price at 9s. per 1000 c.ft. which the Waterford Gas Company may charge to consumers. At the Corporation meeting, Mr. Gallagher said the Board of Trade might have gone further, and taken steps to see that the public got at least a decent light. He used very strong language in describing the quality of the gas supplied. The Board of Trade have made an Order increasing the maximum price of gas in Enniskillen to 11s. 9d. per 1000 c.ft.

Gas Finances at Leeds.—An advance note in regard to a prospective eleven days' exhibition (with demonstrations) of gas appliances by the Leeds Corporation Gas Committee, draws attention to a remarkable change which has come over the fortunes of the Gas Department in recent years. Some years ago, the department was a burden on the rates; and at the end of 1915 there was a deficit of £43,308. At the close of March last, this deficit was down to £20,828; and as a result of successful working during the present financial year, there is stated to be a good prospect that it will see the deficit wiped-out. The increased price of gas has had something to do with the improvement; but much of the credit must go to the way in which the department has introduced the use of gas to the community for extended heating and industrial purposes. The exhibition is to be held at the Fenton Street Drill Hall, from Feb. 15.

GAS REGULATION ACT APPLICATIONS.

The following further notices appear in the "London Gazette" of applications by gas undertakings to the Board of Trade under section 1 of the Gas Regulation Act for Orders.

British Gas Light Company, Ltd. (Norwich).

The maximum prices now authorized in respect of the supply of gas by the undertakers are 4s. 6d. per 1000 c.ft. within the City and the County of the City of Norwich and the precincts of the Shire Hall at Norwich and the parish of Cringleford, and 5s. 6d. per 1000 c.ft. within the remainder of the limits of supply of the undertakers, with a proviso that the price per 1000 c.ft. in any parish, other than the parish of Cringleford, added to the undertakers' limits under the British Gas Light Company, Ltd. (Norwich) Act, 1918, shall be at all times more by at least 6d. per 1000 c.ft. than the price for the time being charged by the undertakers for gas supplied by meter under like circumstances to consumers within the City of Norwich.

The prices which the undertakers have asked the Board of Trade to substitute for these are 1s. 7d. per therm within the City and the County of the City of Norwich and the precincts of the Shire Hall at Norwich and the parish of Cringleford, and 1s. 9½d. per therm within the remainder of the limits of supply of the undertakers, with a proviso that the price per therm in any parish, other than the parish of Cringleford, added to the undertakers' limits under their Act of 1918, shall be at all times more by at least 1½d. per therm than the price for the time being charged by the undertakers for gas supplied by meter under like circumstances to consumers within the City of Norwich.

British Gas Light Company, Ltd. (Potteries).

The maximum price now authorized in respect of the supply of gas by the undertakers is 3s. 6d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s. 4d. per therm.

Liverpool Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 2s. 1d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s. 2·3d. per therm, with a neutral zone of 1·7d. per therm. It is also proposed that additional charges per therm should be authorized in respect of gas supplied through a prepayment meter.

The Company seek also

(*c*) The modification of any provision whereby the rate of dividend payable by the undertakers or any payment is dependent on the price of gas supplied; and

(*d*) The modification of the provisions in the Gas Regulation Act with reference to the minimum pressure to be authorized in certain portions of the area supplied by the undertakers.

Prescot Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s., less 10 p ct., or 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 5d. per therm.

Warwick Gas Company.

The maximum prices now authorized in respect of the supply of gas by the undertakers are 4s. per 1000 c.ft. within a radius of two miles from the southern extremity of the lands described in the first schedule to the Warwick Gas Act, 1915, and 5s. per 1000 c.ft. beyond the said radius; and the prices which they have asked the Board of Trade to substitute for these is 1s. 6d. and 1s. 10½d. per therm respectively.

Wisbech Lighting Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

HACKNEY PUBLIC LIGHTING.

Offer of the Gas Light and Coke Company.

The General Purposes Committee of the Hackney Borough Council report that in 1910, when inverted incandescent burners were substituted for upright incandescent burners in the street-lamps lighted by gas, an arrangement was made with the Gas Light and Coke Company as to the terms on which the lamps should be maintained and lighted by the Company. Each burner was to consume 3½ c.ft. of gas per hour, and the contract was to be for five years, and to provide that "(*a*) the Company shall, at their own expense, carry out the whole of the work of conversion; (*b*) the price to be paid to the Company by the Council shall be at the rate of £2 3s. 6d. per lamp per annum for the gas, lighting, repair, and maintenance of each lamp fitted with one burner, £3 8s. 6d. per lamp per annum for each lamp fitted with two burners, and £4 13s. 6d. per lamp per annum for each lamp fitted with three burners—these prices to be irrespective of any variations in the price of gas during the five years; (*c*) at the end of five years, the Council to have the option of extending the contract for a further five years, at a reduction of 5 p.ct. from the prices named." In 1915, notice was given to the Company of the intention of the Council to continue the arrangement for another five years, with a reduction of price at the rate of 5 p.ct.

The Committee have now received a communication from the Company, drawing attention to the fact that the agreement expired on Nov. 11, 1920, and stating that, owing to the enormous increase in wages paid to the Company's employees, the prices being charged under the agreement, and which they propose to continue to charge until March 31 next, do not even cover the wages bill—leaving nothing to meet the costs of repairs, mantle maintenance, and gas supplied, which have also risen very substantially. To yield the Company the current price for the gas consumed, and to cover all other expenses, it would be necessary to raise the present annual charge by nearly 200 p.ct. The Company are, however, prepared to meet the Council to the extent of raising their charges only to such a figure as will cover outgoings, *plus* such price for gas as they charge to their largest consumers for industrial purposes. The Company are also prepared to base their charges on a sliding-scale, which will automatically adjust the cost of street lighting as the price of gas rises or falls; and they propose that, as from April 1 next until determined by either party giving to the other six months' notice in writing, terminating on March 31, 1923 (or any subsequent March 31), the charge for street lighting and the terms of agreement in respect therefor shall be those contained in the agreement above referred to, subject to an increase of 150 p.ct. on the present total charges. In respect of every penny increase or decrease in the price of gas, above or below the present price of 4s. 8d. per 1000 c.ft., the advance of 150 p.ct. shall be increased or decreased by 4 p.ct. on the previous contract price—*i.e.*, if the price of gas were reduced 5d., the advance would be reduced to 130 p.ct.; if the price were reduced by 10d., the advance would be only 110 p.ct.; and so on. So soon as the price of gas is expressed as per therm instead of per 1000 c.ft., the figure of 0·2d. per therm shall be substituted for 1d. per 1000 c.ft.; and a price per therm based on the average calorific value of the gas supplied during the current half-year will be substituted for 4s. 8d. per 1000 c.ft. It is pointed out by the Company that the proposal put forward by them, though entailing substantially increased expenditure on the Council, only partially relieves the Company of the very heavy loss they are, and have for some time been, incurring on the supply of gas for street lighting in Hackney.

Having given the matter very careful consideration, the Committee are of opinion that the proposal of the Company is a reasonable one in the circumstances; and they submit a recommendation in favour of its being adopted by the Council. In the event of the Council concurring, the increased cost will amount to £3 5s. 3d. per lamp, or approximately £10,000 per annum; and this amount will have to be included as an additional sum in the estimates of the Council for the year ending March 31, 1922.

BIRKENHEAD GAS-WORKS EXTENSIONS.

Discussion in the Town Council.

There was a discussion in the Birkenhead Town Council last Wednesday on a report by the Gas Engineer (Mr. R. H. Brown), with regard to the undertaking. Consideration was also given to resolutions involving an expenditure of £67,879 (being the increased cost of the extension scheme over the estimates of 1919), and £20,400 for purifying plant. Approval was given to an application to the Ministry of Health for sanction to borrow the £20,400 for purifying plant. The remainder of the resolutions, with the Engineer's report, were referred back for further consideration.

The MAYOR (Mr. Luke Lees), who is Chairman of the Gas Committee, explained that the original estimate for the scheme was made in February, 1919; and the cost was to be £121,385. But the sanction of the Ministry of Health was not obtained until February of last year. Since the estimate was framed, there had been a considerable increase in the cost of materials and wages, with the result that the present estimated cost, including the work in hand, was £197,634. It was proposed that the amount should not be spent immediately, but should be spread over the next four years. Steps would be taken to get everything prepared; but contracts would only be accepted when the markets, which were already showing signs of falling, were still more favourable to the Committee. He drew attention to a paragraph in the report which stated that the Council would realize that, whatever financial difficulties might exist at present, they were compelled to proceed with the work immediately, so as to get the new plant into operation before next winter. Otherwise they must take the risk of the town being short of gas, should climatic conditions produce an excessive strain on the plant. But there was such a likelihood of a fall in prices occurring that there was no intention of carrying out the work at once. The purifying plant, however, was an urgent necessity.

Mr. R. P. FLETCHER, criticizing the Engineer's report, quoted several passages which urged that the work should be proceeded with, on the ground that the plant was insufficient to meet a heavy strain in bad or foggy weather. Similar predictions, he said, which were made in the 1919 report had not been fulfilled; and he suggested that the present warnings were also exaggerated. He asked whether the scheme was the full one, or, as in the 1919 report, only a partial one. In 1913, the capital outlay on the undertaking was £490,000; and on March 31 last it had risen to £620,000—an increase of £130,000 in the last seven years. With all the money that had been spent on the undertaking, there should be no necessity for such an extravagant outlay as that indicated in the report.

Alderman R. J. RUSSELL observed that the discussions on the gas undertaking had become nauseous. The Mayor had intimated that he was prepared to wait until prices were more favourable; and he suggested that the recommendations should be taken back and brought forward as occasion arose.

The MAYOR explained that the Committee desired to go to the Ministry of Health with the full rather than a piecemeal scheme.

Alderman J. H. M'GAUL pointed out that the gas undertaking, since its inception, had contributed between £150,000 and £160,000 to the relief of the rates.

Ultimately an amendment was agreed to which had the effect of referring back the report and the proposed expenditure in excess of the 1919 estimate; and the resolution to spend £20,400 on the purifying plant was approved.

Brierley Hill Gas Failure.—The gas supply at Brierley Hill gave-out on Thursday night last; and except for a few electric lights, the town was plunged in darkness. Much inconvenience was caused to industrial concerns. It was subsequently found that there had been a breakdown in the machinery, which it was hoped would be rectified in the course of the next day.

RATEPAYERS AND MANCHESTER GAS PROPOSALS.

At the close of a meeting of ratepayers in the Town Hall, Manchester, last Wednesday night, Alderman W. Kay (who is Lord Mayor and Chairman of the Gas Committee) declared that those present had done the city out of the best bargain it had ever made, and had deprived Manchester of a very great opportunity to develop to its own advantage. He further intimated that he would call the City Council together, to consider the desirability of taking a poll.

The reason for these remarks was the defeat by the meeting of the proposals relating to the gas undertaking which were contained in a Bill to be promoted by the Corporation in the forthcoming session of Parliament. These included the purchase of the Stretford Gas Company's undertaking, and a scheme for the erection of gas-works farther down the Ship Canal, at Partington. The intention was ultimately to cease to manufacture gas in Manchester, and to use the existing works only as distributing stations. Referring to the matter, the "Manchester Guardian" said: "This proposal was regarded in the Council in the light of an agreed measure; and it was therefore something of a shock to the Councillors who were present at the meeting to find that the majority of the ratepayers in the hall were opposed to it. There was little pretence that the opposition was based upon the merits of the proposal. It came in the main from those who had been disappointed by the action of the City Council in deleting from the Bill the clauses relating to the rating of land values. Evidently they considered that a legitimate way of making a protest was to wreck the rest of the Bill. The suspicion which was voiced in the Council that the land values clauses had been defeated by a trick had found an echo outside among those who believed that these clauses were the most important part of the Bill; so that the deletion of the gas proposals was nothing more or less than an expression of indignation against the Conservative party in the Council. However correct and desirable in the public interest the procedure adopted at the Council meeting may have been, the citizens at the town's meeting thought that an unfair advantage had been taken, and that they ought to have been consulted in the matter. To a small extent the opponents of new expenditure of any sort swelled the voting against the measure; but in ordinary circumstances their opposition would have been negligible."

The Lord Mayor, in moving the resolution in favour of this part of the Bill, pointed out that 81 p.ct. of the total capital in the Manchester gas undertaking was free of interest, and only £604,000 was a debt. In a financial position it was far ahead of any other town. The price of £285,000 for the Stretford works was exceptionally cheap, even compared with pre-war prices.

An extension is to be made at the Troon Gas-Works. The estimated expenditure, which includes vertical retorts, is £22,000.

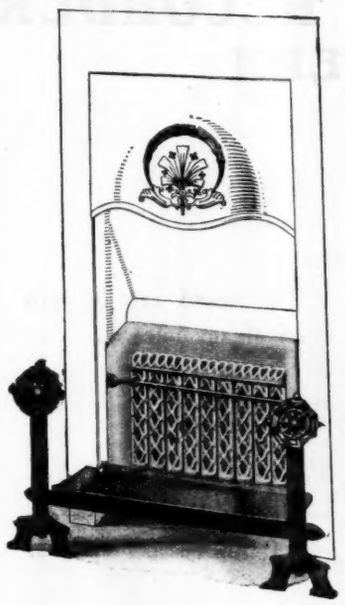
INDUSTRIAL GASEOUS FIRING.

At the Coventry Engineering Society, on Friday, the 7th inst., Mr. A. Docking, of Dublin, dealt with "Industrial Gaseous Firing." He pointed out that gas had become popular as a heating agent, because it was clean and reliable, required less labour, ensured better production of work, and, in most cases, was the cheapest of all fuels. There were thousands of gas-fired furnaces in use; and there were few industries not using gas in one form or another. Gas undertakings, however, must not assume they had a hard-and-fast monopoly, because if they did they would get a sad awakening. He explained the different systems of industrial heating appliances and the design of furnaces, and pointed out numerous important considerations—giving, by means of lantern slides, illustrations of various classes of furnaces in use. Speaking of the advantages of gaseous firing over solid fuel, he referred to economy in fuel and constant regularity of temperature; while he stated that the efficiency of an electricity generating station was much below that of a gas-works. He urged that gas companies and municipal authorities should equip laboratories for assisting gas users, gas appliance manufacturers, and the public generally, in arriving at solutions to the many problems with which they were faced. The fields of research and development were many and wide; and the cost of exploring them should prove a profitable investment.

Mr. P. N. Langford (Manager of the Coventry Corporation Gas-Works) thought that gaseous firing was now used in 3000 different trades. In Coventry, in the early days of the war, there was a great demand for gas-furnaces; and later on they got into such a state with the growth in the consumption of gas, that they were absolutely afraid they would not be able to supply the demand. In 1919, the Gas Committee placed an order for a very big extension at the works; and the question of a demonstration room and a campaign for pushing gas for industrial purposes was delayed simply because they could not supply the gas. They hoped next winter, if the contractors fulfilled their obligations, to have a gas demonstration room; and then he thought they would go ahead to push the sales for industrial and other power purposes, and show, as in Birmingham, Sheffield, and Glasgow, what could be done.

Replying to questions, Mr. Docking said that, with regard to the Severn barrage scheme, even if the scheme were carried through, electricity would stand no chance of comparing with gas in its ultimate cost to the consumer. High-pressure gas could be distributed over long distances much cheaper than electricity. With reference to blast-furnace gas, he understood that up in the North this gas was used for high-power engines; but he had never seen it employed in connection with melting.

Mr. Crawford informed the lecturer that he had seen blast-furnace gas used, not for melting, but for pre-heating ingots for rolling; and Mr. Docking replied that he thought its use in this way was quite possible.



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An Appreciation.

"The three 'Entente' Fires supplied to me are most satisfactory in every way, and the burner is all you claim for it. I was rather doubtful before I had tried it whether it would be right at varying pressures, but have found it to adapt itself to all pressures and calorific powers without lighting back. I have had plenty of opportunity to test it during the past fourteen days, due to the coal strike and consequent reduction in quality of gas supplied.

"The Fire has a most pleasing effect when supplied with gas of standard pressure and quality. The fuels are fully heated to the top at a regular temperature, from bottom to top, not simply bright for the first three inches and the remainder quite dull.

"*You can certainly recommend them with every confidence to your customers.*"

R. & A. MAIN, LTD.

PROPOSED ENGINEERS' CLUB FOR LONDON.

[COMMUNICATED.]

An earnest endeavour is being made to found an Engineers' Club in London. The idea is an excellent one, and it ought to be carried out on the broadest lines possible. The term "engineer" should be made elastic, and should include those who, in the words of the Charter of the Institution of Civil Engineers, turn the great forces of Nature to the use and convenience of man. A club catering more or less for engineers has been tried on one or two occasions, and has not matured satisfactorily. What should be attempted now is an Engineers' Club in the widest sense, domiciled in London, with a membership obtained, not from London alone, but from the Provinces and from our Overseas Dominions.

The provision of a common ground, free from all political bias, where engineering thought can find a congenial atmosphere, must be of inestimable value to the development of a profession and industry on which largely depend the safety and well-being of our Empire. If we want to listen to papers, why should there not be a common meeting-place, where we could dine in comfort before the debate, and wipe-away all asperities when it was over in a sociable smoke and drink together? Nothing can help engineering—the one great constructive force to-day, as it was yesterday, and will be for all time—more than a gathering together of its vital component parts on the lines indicated above. Such a club, where members from the Provinces and Overseas could find a home, would provide the means.

It is impossible to look upon the financial aspect of such a venture with pre-war eyes. A subscription which might have been ample six years ago, owing to enhanced values must now be more than doubled. An Engineers' Club in London should not be started with less than 1000 original members, at an annual subscription of (say) ten guineas. The scheme for the financing of an enterprise of this kind must receive close attention at a later date; and due regard must, of course, be paid to favourable terms for Provincial and Overseas members. The difficulties are fully realized, but are believed to be not insurmountable. To make the club a success, it must be run as a club, and not as a glorified saloon bar. The latter course has been adopted by certain clubs in London to-day.

The club should aim at giving, at the lowest cost, the best service possible. It should be a club established for the benefit and advantage of its members, run on co-operative lines, and not a camouflaged hotel worked for the sake of profit. Four things are essential to bring about the end in view: First, the assurance of the moral support of all engineering interests; secondly, the necessary financial support; thirdly, the setting-up of a really strong and representative Honorary Committee, composed of men who would give a large amount of time, trouble, and attention to the formation and conduct of the club; and, fourthly, the finding of a man of experience, who could run such a club economically and successfully. No amateur, however good, could "fill the bill." The club would need the best that money could buy—a full-time man of great experience in management, buying, and catering, of long and varied knowledge of club management; and a gentleman—in the best meaning of the word—would be essential. There should be generous bedroom accommodation, for the country membership will be large; and for the same reason it might be well to have a linking-up arrangement with the Engineers' Clubs in Manchester and Birmingham.

We are glad to know that a strong Preliminary Committee, comprising prominent men in the civil, mechanical, electrical, gas, transport, iron and steel, shipbuilding, and other branches of engineering, is being formed, in order to explore the possibilities.

As it is vitally important for the framers of a scheme to have some idea of the magnitude of the probable membership, readers who are in favour of such a club are invited to send their names to Mr. Edmund L. Hill, No. 39, St. James's Street, S.W. 1, who has consented to act *pro tem.* as Honorary Secretary to the Committee.

TRADE NOTES.

[For "Journal" Advertisers.]

Baffle-Bridges for Boiler Furnaces.

Following upon the installation during September last of patent baffle-bridges in steam-boilers at their Fulham and Bow Common Gas-Works, the Gas Light and Coke Company have now placed an order with the makers—Messrs. Gallagher and Crompton, of No. 3, Upper Cleminsqn Street, Salford—for thirteen additional sets of baffle-bridges for twenty-six boiler-furnaces. These, as in the case of the former installations, are to be fitted to furnaces equipped with modern forced-draught apparatus of various types, including the well-known "Wilton" and "Turbine" apparatus. For use with coke or breeze as fuel, this combined equipment tends very materially towards the maintenance of a high degree of thermal efficiency under everyday conditions of service, and at the same time reduces to the minimum the arduous labour of removing from the furnaces the unavoidable accumulation of clinker.

"Turbine" Furnace Installations.

Orders have recently been received by the Turbine Furnace Company, Ltd., of No. 5, Budge Row, London, E C., from the Wellingborough Gas Company for one set of "Turbine" patent furnaces for a Stirling type boiler. The Burton-on-Trent Gas-Works, for one set of furnaces to suit a 30 ft. by 8 ft. 6 in. Lancashire boiler. This is a repeat order—two furnaces having already been fitted up. The South Metropolitan Gas Company, Old Kent Road, for one set of furnaces for a 27 ft. by 8 ft. Lancashire boiler. The Leicester Gas Department, for three sets of furnaces for 8 ft. 6 in. diameter Lancashire boilers. This is a repeat order—ten furnaces being already installed. The Gas

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Highest Range: 0-300 lbs. per sq. inch.

Suitable for Gas, Air, Water, or Steam, and may be used on Crude Gas.

MAKERS:

ALEXANDER WRIGHT & Co., Ltd., WESTMINSTER

Light and Coke Company, for their tar and ammonia products works at Beckton, for one set of furnaces for a 24 ft. by 7 ft. Lancashire boiler. This furnace will burn readily coke breeze, and old and, what has hitherto been considered, worthless rubbish, such as is usually thrown on to colliery dumps. It is a reliable and steady steam-raiser, and will also readily respond to varying load. It is pre-eminently suited for use in gas-works, chemical works, &c.

"Meldrum" Forced-Draught Furnaces.

The past year constituted a record in the fitting of the forced-draught furnaces of Messrs. Meldrums, Ltd., of Timperley, near Manchester; and, apart from the big increase in sales, a noteworthy feature is the large number of repeat orders received. The "Meldrum" furnace was the pioneer in forced-draught practice—the first one being installed in the year 1889. Since then the system has been kept up-to-date by actual and continuous practice. Nearly 18,000 "Meldrum" furnaces have been fitted—representing some 2,500,000 H.P.—all over the world. The furnace is adaptable to every type of boiler, and consumes all classes of fuel. Long practice and careful research have evolved the present blowers, which consume the smallest amount of steam compared with work done. This naturally varies according to the class of fuel used, but does not exceed 3 to 4 p.ct. of the total steam raised. To balance this, it must be remembered that the very cheapest fuel may be used, while the boilers give even more steam than when the best coal was employed. It must not be thought that heavy replacement expenses are a necessary corollary to forced draught. The "Meldrum" bars being thin, the number of air-spaces is much greater than where ordinary bars are used; and the maximum of "windage" is therefore obtained. It has also been found that, with the narrow spaces, holes are not liable to be blown in the fires, and combustion is equalized over the whole grate; also the cooling action of the steam and air draught gives the bars a long life. The chief constructional points claimed for the furnace are: The blowers are of the correct design, and fewer jets are used. The draught is delivered into the ash-pit direct; an equal pressure being maintained under every part of the grate. The fine ash falls clear of the grate, and leaves the air-spaces always open for air-passage. The furnace is most easily cleaned. The blowers may at any time be put out of operation, the ash-pit doors removed, and the boilers worked under natural draught, if so desired.

Radcliffe Joint Gas Board.—The statutory meetings of local government electors in the urban districts of Radcliffe, Prestwich, Whitefield, and Little Lever, to assent or otherwise to the promotion of a Bill in Parliament for sanction to purchase the undertaking of the Radcliffe and Pilkington Gas Company on behalf of a Joint Gas Board representative of local authorities in the area of gas supply, have been held; and the decisions were: For, Radcliffe and Little Lever; against, Prestwich and Whitefield. It has been officially stated that, if all the other local-governing bodies dropped out of the scheme, Radcliffe would go forward on its own account.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 17.

On the London market, the tone is quiet but steady. It is now well understood that the production of tar during the present half year will be less than recently; while the demand for road purposes is expected to be larger than last season. For these reasons it is a reasonable forecast that the make of pitch for January-June will be reduced compared with recent periods. For export, the minimum price of pitch is 190s. net per ton. It is thought that negotiations with the French buying office are pending. Deliveries under contracts are being readily shipped. Creosote is worth about 1s. 2½d. net per gallon in bulk. Other products are unchanged, as also is sulphate of ammonia for Home agriculture.

Tar Products in the Provinces.

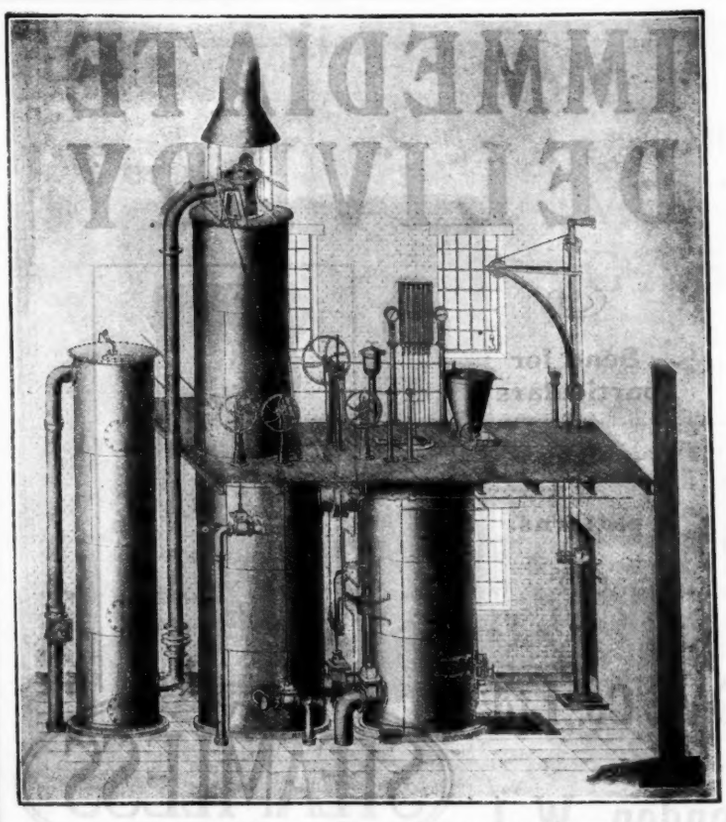
Jan. 17.

The average values for gas-works' products during the week were: Gas-works coal tar, 110s. to 120s. Pitch (all pitch prices are purely nominal) East Coast, 175s. to 180s. per ton f.a.s.; West Coast—Manchester, 175s. to 180s.; Liverpool, 175s. to 180s.; Clyde, 180s. to 185s. Benzole 90 p.ct. North, 3s. 1d. to 3s. 2d.; crude 65 p.ct. at 120° C., 2s. 3d. to 2s. 5d. naked at makers' works; 50-90 p.ct. naked, North, 3s. 2d. to 3s. 3d. Toluol, naked, North, 3s. 1½d. to 3s. 2½d. nominal. Coal tar crude naphtha in bulk, North, 1s. 2d. to 1s. 3d. Solvent naphtha, naked, North, 3s. to 3s. 2d. Heavy naphtha, North, 3s. 1d. to 3s. 3d. Creosote, in bulk, North, liquid, 11½d. to 1s. 0½d.; salty, 11d. to 11½d. Heavy oils, in bulk, North, 1s. 1d. to 1s. 2d. Carbolic acid, 60 p.ct., 2s. 3d. to 2s. 4½d. Naphthalene, £37 10s. to £40; salts, £10 to £10 10s., bags included. Anthracene, "A" quality, 1s. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

This market remains very quiet, and prices of many lines are showing a somewhat easier tendency. There is very little being done in pitch at present, and conditions are rather uncertain. There has been a slackness of orders from the Continent for briquettes which has caused some of the South Wales works to be shut down; but there seems to have been rather more inquiry from Continental buyers of pitch, although they are putting forward some low offers as the basis of purchase. Negotiations with the idea of bringing out a combine of purchasers are still in progress; but this does not appear to have helped the market very much. One thing, however, is certain—namely, that requirements for the current season have still to be covered, and very much will depend upon the attitude of holders. There is



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practically no change in solvent naphtha. The demand remains poor, without any alteration in prices. Naphthalenes are very weak. The demand for all qualities has fallen away, and refined qualities are offered as low as £28 per ton; there being a large quantity of refined flake on the market for re-sale. Creosote is somewhat easier; but the closing-down of many coke-ovens will prove a strong point in this connection in the near future. Carbolic acid is very flat. There are reports of 2s. per gallon being accepted for crude qualities. Crystal carbolic is also lower. There is not much doing in cresylic acid; but the small amount of business passing has been effected at lower quotations. There is not much fresh to report in intermediate products, which, on a small amount of business, have been able to maintain their quotations.

The range of quotations is as follows:

Benzole: 90% London 3s. 10d., North 3s. 7d. to 3s. 9d.; 50-90% 3s. 3d. London, 3s. to 3s. 1d. North; crude 60-65%, 2s. 3d. to 2s. 5d.; pure, 3s. 3d. per gallon naked.

Crude Tar: London, 105s. to 115s.; Midlands, 107s. 6d. to 112s. 6d.; North, 105s. to 107s. 6d. per ton *ex* works. Refined tar, 85s. per barrel (free) on rail.

Pitch: London, 200s. to 205s. per ton f.o.b.; East Coast, 195s. to 200s. per ton f.o.b.; West Coast, 195s. to 200s. f.a.s., with Manchester 200s. per ton, and Glasgow 195s. per ton; South Wales, 210s. per ton.

Solvent Naphtha: 2s. 9d. per gallon.

Crude Naphtha: Naked, 11d. to 1s. 1d.; North, 1s. per gallon.

Heavy Naphtha: 3s. 2d. per gallon.

Naphthalene: Refined flake, £26 to £35 per ton nominal; inferior, £25; crude, £14 to £18 per ton, according to quality.

Toluol: Naked, 3s. 4d. per gallon nominal; North, 3s. 2d.; pure, 4s.

Creosote: London, 1s. 2d. to 1s. 3d.; North, 1s. 2d.; heavy oil, 10½d. per gallon in bulk.

Anthracene: 40-45%, 1s. 3d. to 1s. 4d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 5s. per ton f.o.r. makers' works.

Pyridine: 18s. to 22s. 6d. per gallon.

Aniline Oil: 1s. 7d. per lb., drums extra.

Aniline Salts: 1s. 9d. per lb.

Cresylic Acid: Crude, 2s. 6d.; dark 95-97%, 3s. 3d.; pale 97-99%, 3s. 9d., per gallon, drums free.

Carbolic Acid: Crude 60%, 2s. 3d. per gallon; crystals 40%, 8d. per lb. nominal.

Salicylic Acid: Technical, 1s. 8d.; B.P., 2s. per lb.

Xylol: Pure, 4s. 3d.; commercial, 3s. 9d. per gallon.

Resorcin: 7s. 6d. to 8s. 6d. per lb.; pure, 21s. per lb.

Alizarine 20%: 2s. per lb.

B. Naphthol: 2s. 6d. per lb.

Sulphate of Ammonia.

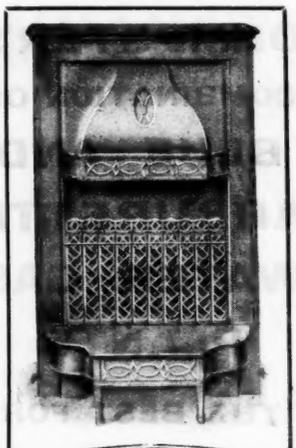
This material has been attracting a little more attention at the reduced prices. A good demand for spring delivery is reported. Export prices appear to be dropping. During December our exports amounted altogether to 10,429 tons, compared with 13,186 tons in November. Our best customers in December were Spain and the Canary Islands, taking 4529 tons, the Dutch East Indies with 1600 tons, and France with 1186 tons. The British West India Islands (including the Bahamas) and British Guiana took 385 tons. The total exports for the year amounted to 110,042 tons, which compares with an annual export of 92,866 tons in 1919 and 323,054 tons in 1913—the last complete pre-war peace year.

In America, the market is very weak and lifeless. Prices give way owing to the absence of demand for both home and export needs. Second-hand holders are willing sellers at easier prices, and a bearish note seems to prevail throughout the whole market. It is known, however, that large consumers of late have been keeping out of the market on purpose to try to seize lower prices. They will have to enter again some time in the not far distant future, however; and their orders will no doubt improve matters.

Attention has been called to an error in last week's report, where it was stated that 1s. 7d. per gallon has been taken off the price of petrol—instead of 7d. per gallon.—ED. "G. J."

Midland Tar Distilling Scheme.—A discussion has taken place in the West Bromwich Town Council on a recommendation of the Gas Committee to join in a scheme for ten years for the distillation of tar on a co-operative basis by the Midland tar producers and tar distillers. The Committee recommended the Corporation to join in the scheme; and the Mayor said the tar would be sold to the distiller on a basis price of 1½d. per gallon (25s. per ton), delivered to the nearest works. The price realized by the disposal of the products distilled from the tar would be apportioned according to an agreed scale between the distiller and the producer, in addition to the 25s. per ton paid to the producer. The recommendation of the Committee was adopted.

Newbiggin Gas Company and the Consumers.—A public protest meeting convened by the local labour party has discussed the quality and price of the gas supplied by the Newbiggin Gas Company, and a proposed subsidy to the Company by the Council to lay mains to new houses. Mr. Doney moved that a demand for a rebate be made, and that a protest against the subsidy be placed before the Council. In paying 7s. 6d. per 1000 c.ft., he contended that the public were being charged for something they were not getting. Mr. Carrick, supporting, said 7s. 6d. per 1000 c.ft. would be an excessive charge for the purest gas in the kingdom. Referring to the application for a subsidy, he described it as preposterous, especially on the part of a Company who had failed to fulfil their obligations to the public. He suggested that electricity should replace gas, and said he felt that in municipal enterprise lay the solution of all their troubles. The resolution was carried, as was also one calling upon the Council to invite electrical companies to supply the district, and canvass the residents.



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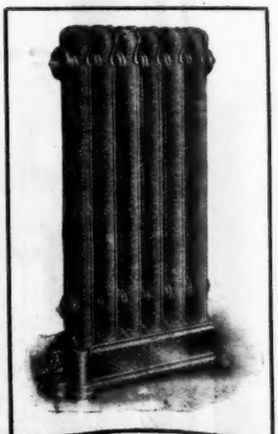

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DAVIS "STEAMLESS" Radiators

British Industries Fair.

Considerable progress has been made with the Birmingham Section of the forthcoming Industries Fair, at which gas equipment will be a prominent feature. The entry by manufacturers is larger than that of last year. The London and Birmingham Fairs run concurrently from Feb. 21 to March 4; while the Glasgow exhibit opens a week later, on Feb. 28. Intending visitors will therefore have no difficulty in getting from one section to another. Only British manufacturing firms are allowed to show, while the goods must be of the exhibitors' actual manufacture. At the Birmingham Exhibition, metal goods and general hardware and motor cycles and cycles will again be largely represented; but next to the first two named, lighting, cooking, and heating appliances will occupy a position of chief importance. The entry includes a wonderfully wide range in chandeliers, candelabra, and gas-fittings, electric light and accessories, table lamps, hall lamps, standard lamps, and cooking and heating stoves of all kinds. The last-named constituted one of the most interesting features at last year's fair; and at the forthcoming display at Castle Bromwich, noteworthy developments are promised on the gas and electrical sides. As previously, the gas manufacturers' stands will be in the first or "A" Aerodrome; and on this occasion all three huge buildings will be connected.

Vulcan Meter Company.—A private company bearing this title has been registered, with a capital of £5000 in £1 shares, to acquire certain inventions connected with dry gas-meters, and to acquire the business of gas-meter manufacturer carried on by Mr. J. Hill in Birmingham.

Public Lighting Charges at South Shields.—The Public Lighting Agreement Sub-Committee of the South Shields Corporation have considered a letter which the Town Clerk had forwarded to the South Shields Gas Company stating that the Council would be prepared to pay the extra cost incurred by the Company as from July 1, 1919, in performing public street lighting services—comprising lighting, extinguishing, and maintenance, but excluding gas supplied over and above the contract price. The agreement (which terminates on March 31 next) being renewed or continued, it must be understood that the Council reserve the right to make such modification in the new agreement as they may think desirable. The Directors declined to accept the Corporation's offer to pay only the additional cost as from the date named, and suggested a further interview with the Sub-Committee to go into the matter. Subsequently, Mr. Dugald Currie (Engineer to the Company) interviewed the Sub-Committee, and discussed at length the offer of the Corporation, and submitted the views of the Company thereon. After discussion, the Sub-Committee agreed to the Gas Engineer's proposal that the Council should pay £5000 in full settlement of the Company's claim up to Sept. 30, 1920; from that date the Company to be repaid the actual costs incurred until March 31 next, when the present agreement expires. The Sub-Committee recommended accordingly.

Further Plant for Teignmouth.—The Gas Committee recommended to the Teignmouth Urban Council on Tuesday of last week that the Gas Manager (Mr. H. Higham) obtain tenders for the erection of a relief holder; that the provision of a booster pressure-raising plant, condenser, and exhauster be considered; and that the manager report as to the condition of gas-mains in the town. The recommendation was adopted. The Council regretted being unable to give effect to the request of a town's meeting that independent advice on the condition of the gas-works should be sought.

Stafford Gasholder Contract.—The Stafford Town Council have decided to allow Messrs. C. & W. Walker, Ltd., a further £600 towards a loss of £6400 incurred by the firm in connection with the building of a million c.ft. gasholder and tank. The Corporation had previously contributed £2600 towards the loss, which, it was stated, was due to circumstances beyond the firm's control. It was mentioned that the contract price for the holder and tank was £11,841; and that at current prices the cost of the holder would be about £40,000. Alderman Young said the extra contribution was only reasonable in the circumstances.

Quality of Gas at Westhoughton.—The quality of the gas supplied at Westhoughton was criticized at the District Council recently, when Mr. Pilkington said there had been shoals of complaints. Through the gas petering-out at a local colliery, the engine-man could not see the indicator. A cage of men was being lowered at the time, and was stopped halfway until storm-lamps could be procured. This was a most serious thing. The Chairman said they had played with the matter long enough. Steps ought to be taken to bring those responsible to book. It was stated that the Council were in negotiation with the Lancashire Electric Power Company, with a view to the streets being better lighted. The Clerk gave a report upon the Westhoughton Gas Act 1871, with Counsel's opinion as to the steps to be taken to force the Gas Company to comply with their statutory obligations as to quality. He was instructed to take all necessary steps.

Loughborough Gas Profits.—The Gas Committee, of which the Mayor is Chairman, presented a report at the last meeting of the Loughborough Town Council, dealing with the undertaking for the half year to Sept. 30, which showed a total expenditure of £19,745 and receipts from the sale of gas and residual products of £24,102, leaving a balance of profit of £4356. The Mayor expressed the hope that a period had now been reached when it would not be necessary to further increase the price of gas. It was satisfactory they had made such a profit compared with £250 only in the corresponding half of 1919—this being due to the increased price charged. The result was that the heavy adverse balance of £1227 with which they started had been reduced to £582. Before the war they had a balance of from £3000 to £4000, which they had intended to spend upon plant. It had been gradually going down, however; and he hoped the Council would not lower the price of gas until they got the balance back to its original amount. Otherwise it would mean that they would have to borrow capital for certain purposes.

The "KALO," No. 2710.

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VENTILATING GAS FIRES.

The "O.K." Series.
"Kalo" Square Top. "Olak" Round Top.
"Loka" Shelf Top.

These Fires have received the highest commendation from Medical Authorities. They are fitted with patent "Injector-Ventilator" and patent "Thermo-X" Firefront. All working parts of same size Fires are interchangeable. Orders should be placed at once to cope with Season's demand.

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BIRMINGHAM.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Jan. 12.]

Nos. 1 to 1133.

ADAM, W. G.—"Purification of coal gas." No. 296.
BAMBER, H. W.—"Producer-gas generators." No. 576.
BARNES, F. V.—"Incandescent gas-lamps." No. 697.
BERGMAN, N.—"Gas-lighter." No. 915.
BIRKHOLZ COMPANY—"Gas-burner." No. 366.
BOOCOCK, M.—"Recovery of ammonia from ammoniacal liquor." No. 515.
BRETT, C. G.—"Inverted gas-burners." No. 430.
BROCKER, H.—"Gas producing and heating apparatus." No. 1133.
CAMBRIDGE AND PAUL INSTRUMENT COMPANY, LTD.—"Detection and measurement of gases." No. 1117.
CHEMISCHE FABRIKEN WORMS AKT.-GES.—"Manufacture of constituents of low boiling point from tar products, resins, mineral oils, &c." Nos. 289, 456.
CHENARD, E. A. R.—"Fractional distillation." No. 167.
DAVIS ENGINEERING COMPANY, LTD., W. J.—"Gas-valve for geysers, &c." No. 172.
DAYNES, H. A.—See Cambridge. No. 1117.
ERDMANN, E.—"Obtaining paraffin from lignite tar, coal tar, or shale tar." No. 727.
ERDMANN, E.—"Treatment of bituminous tars, mineral oils, tar distillates, &c." No. 728.
EVERETT, S.—"Apparatus for distillation of carbonaceous materials." No. 234.
FOLLIET, A.—"Low-pressure burners for liquid combustibles." No. 267.
FOX, T.—"Prepayment mechanisms for meters and automatic delivery machines, &c." No. 499.
FREYN, BRASSERT & CO.—"Method of gas-washing." No. 365.
GEWERKSHAFT VER. CONSTANTIN DER GROSSE—"Continuously-working distilling-oven for manufacture of gas and coke." No. 1093.
GIZLER—See Bergman. No. 915.
GREENWOOD, S. D.—"Inverted gas-mantle protector" No. 551.
GRIEVE, B. E.—"Means for operating supply cocks of gas-burner rings." No. 112.
HALBERGERHÜTTE GES.—"Treating plants for filtration of combustible gases." No. 819.
HEINICKE, H.—"Gas-indicators." No. 434.
HEINICKE, H.—"Devices for measuring air and gas pressures." No. 435.
HOLMES AND CO., LTD., W. C.—See Boocock. No. 515.
JACKSON, J. L.—"Valves." No. 548.
JACKSON, J. L.—"Gas cut-off apparatus." No. 549.
JACKSON, J. L.—"Gas shut-off valves." No. 550.
KÄMPE, H.—"Gas-stoves." No. 642.
MITCHELL, E. A.—"Apparatus for compressing and delivering gas." No. 303.
PARKER, J. W.—See Bamber. No. 576.
PARKINS, T. B.—See Davis. No. 172.
RAYBOULD, A.—"Revolving nosepieces for gas-fittings." No. 926.
ROBERTS, J.—"Carbonization of coal." No. 72.
ROBINSON, S.—See Fox. No. 499.
SALERNI, P. M.—"Apparatus for distillation of carbonaceous materials." No. 234
SHEPHERD, F. D.—"Gas-engine valve." No. 733.
SHEPHERD, F. D.—"Gas-engine." No. 1001.
SMITH, S. M.—"Fitment for upright gas-fires for toasting bread." No. 1.
SMITH, E.E.—"Mantle boxes." No. 23.
SPINDLER, F G.—"Gas-regulators of incandescent burners." No. 707.
STILL, C.—"Saturators for producing solid salts by treatment of gases with liquid." No. 1097.
SVENSKA AKTIEBOLAGET MONO—"Registering devices for gas-analyzing appaiatus." No. 313.
TULLOCH, T. G.—"Gas-producers." No. 293.
VALENTINE, H. S.—"Atmospheric gas-burners." No. 39.
WALMSLEY, A. E.—See Smith. No. 23.
WYLD, W.—See Boocock. No. 515.

Newry Gas Undertaking.—The Local Government Board for Ireland have forwarded to the Newry Urban Council a copy of an Order authorizing the raising of the price of gas in the town from the statutory maximum of 7s. 6d. per 1000 c.ft. to 9s. 6d. Mr. Cronin (the Clerk) said he understood the Gas Committee had decided upon an increase of 1od. only—that was, from 7s. 6d. to 8s. 4d. He mentioned that he could not reconcile the amended estimate of the Gas Manager with the figures presented to the Gas Committee in October last. If the Committee were satisfied with the 1od., well and good; but so far as he could see it would result in a considerable loss on the year's working—and that, too, without taking into account the loss on the previous year's trading, which, in the ordinary course, should have been made up this year. Mr. H. J. M'Conville, J.P. (the Chairman of the Council) suggested that the matter be allowed to rest until the end of the year. Mr. Ruddy said they were £3000 or £4000 to the bad. Mr. Keer said, on the Gas Manager's figures of a few months ago, the state of affairs was alarming; and he was agreeably surprised to hear that an increase of 1od. would suffice. Apparently, the exact position was exaggerated, or at any rate there was an over-estimate. At all events, the revenue had greatly improved owing to the sale of coke and other residuals, and, so far as he could judge, the 1od. increase would leave them with a loss of only £375 or £400 at the end of the year's trading. The matter was ultimately allowed to stand until the close of the financial year.

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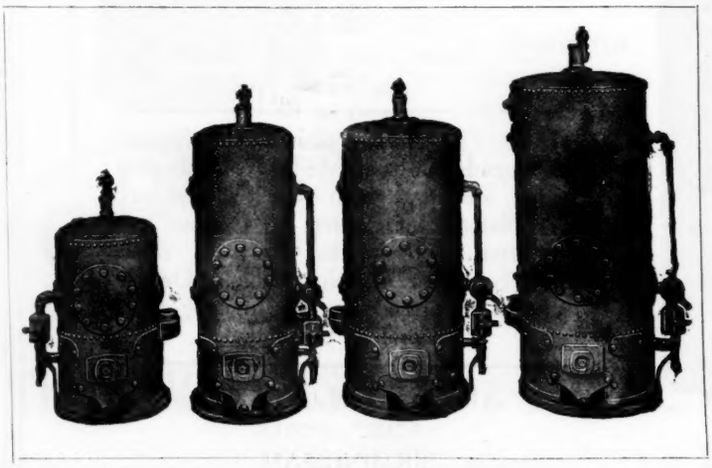

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Ennis Gas and Electric Company.—The registration is announced in Dublin of the Ennis (co. Clare) Gas and Electric Supply Company, with a capital of £5000 in £1 shares.

Bala Gas Company, Ltd.—At a meeting of shareholders on Feb. 25 the Liquidator will report, showing how the winding-up of the Company has been conducted and the property disposed of.

Spenborough Gas Scheme.—An extraordinary general meeting of shareholders of the Heckmondwike and Liversedge Gas Company is to be held on the 31st inst., to consider a resolution providing for the sale of the Company's undertaking to the Spenborough Urban District Council. The provisional agreement for the transfer was signed last Wednesday. The Spenborough Council are seeking powers to purchase the undertaking and the Gomersal Gas-Works, in order to equalize charges for gas throughout the Council's area, and to consolidate the gas-works serving the three townships of Cleckheaton, Liversedge, and Gomersal, which together comprise Spenborough.

Fire broke out last week in a nursing home at Bradford, owing, it is believed, to the fusing of an electric wire.

A tragic discovery was made last week in a house at Shrewsbury, when a pay clerk was found dead with a piece of gas-piping in his mouth. The evidence showed that he had taken a pair of pliers, wrenched the gas-piping away from the wall, put it in his mouth, and turned the gas on. The Coroner at the inquest returned a verdict that deceased "Committed suicide during a fit of temporary insanity by inhaling gas."

The Ossett Town Council, on the recommendation of the Gas Committee, and in the face of some little opposition, have decided to increase the salaries of certain officials, including Mr. A. E. Mottram, the Gas Manager. Mr. Mottram's increase is by £100 per annum; and it was pointed out that this meant a total rise of 100 p.ct. on his pre-war salary, as against increases to the Corporation's workmen of from 160 to 200 p.ct.

STOCK MARKET REPORT.

The Stock Exchange has had a quiet week, immune from any element calculated to perturb its equanimity, and has enjoyed a very fair amount of steady business, to a great extent effected in the superior investment departments. The general tendency was favourable on the whole; but the serious condition of the country's trade pressed hard upon several undertakings in the Miscellaneous Market.

The gilt-edged department did well on the whole. Home Government issues were in good demand, and made further additions to their advances of the week before. Friday's figures for the big four were: Consols 47-47⅛, War Loan 83⅜-84, Funding 67 15/16-68¼, Victory 74⅞-75⅛. Bonds did well, and Corporation issues rose until they were checked by realizations. Home Rails were rather dull; but Grand Trunks were firm, and Argentines improved.

The Foreign Market was stronger; Belgian, Greek, Brazilian, Chinese, Japanese, and Argentine being noticeable in this respect.

The Miscellaneous Market had its weak points. Rubbers and Oils were irregular, and fluctuated a good deal. Banks were firm; but Shipping and Iron and Steel were easier.

Business in the Gas Market, in the aggregate, was about on a par with the week before; but its limitation almost to the ordinary issues of the three principal undertakings was strongly in evidence—the rest having an odd bargain or two thrown in here and there. However, the general tendency was unimpaired and continued to be favourable. In the London Companies, Gas Light ordinary advanced 1, and South Metropolitan ordinary 2 points. Commercial was not dealt in. In Suburban and Provincial, Alliance and Dublin debenture was quoted *ex div.*, without change of price; but Bournemouth debenture had a fall. In Continentals, Imperial was active and firm; the price marked rising from 120 to 125. Primitivas were unchanged. Bombay fell ¼.

Bargains done for cash during the week were as follows: On Monday, Bombay 4, Brentford "B" 51, 51½, Gas Light ordinary 56, 56⅛, 56⅓, Imperial Continental 120, 121, 121½, 123, Primitiva preference 21s., 21s. 6d., South Metropolitan 63¼, 63½, Barnet District "A" 119⅜, 120. On Tuesday, Alliance and Dublin 40, Bournemouth debenture 55, European 5½, Gas Light ordinary 56⅜, 56⅝, 57, 57⅜, ditto maximum 37½, ditto preference 56⅛, 57¼, Imperial Continental debenture 92, Primitiva preference 21s., 21s. 6d., South Metropolitan 63½, 64, 64⅛, 65, South Suburban 58, 58⅛, Southampton 56, Cheltenham 5 p.ct. ordinary. On Wednesday, Alliance and Dublin 40⅛, Bombay 4, British 21⅛, Gas Light ordinary 56⅝, 57, 57¼, 57½, 58, Imperial Continental 119, 121, 121¼, 121⅜, ditto debenture 92⅛, Primitiva preference 21s. 3d., South Metropolitan 63, 64½, 65, Tottenham "B" 50½. On Thursday, British 21⅜, Gas Light ordinary 57¼, 57½, 58, ditto preference 56⅛, ditto debenture 47, Imperial Continental 121, 121⅛, 122, 122⅛, 122⅜, 123, 123⅜, Primitiva preference 22s., South Metropolitan 64, 64⅛, 64⅜, 65. On Friday, Alliance and Dublin 40¼, Gas Light ordinary 57⅛, 57⅜, 58⅛, Imperial Continental 122, 123, 123⅛, 123⅜, 124, 124⅛, 124⅜, 125, Primitiva preference 22s., Tottenham "B" 51, 51⅛, 51⅛.

In the Money Market, there was a fair demand on a moderate scale which was not of a character to create any stringency; and the situation was firm at the close. Discount was quiet and held steady. Silver varied very slightly from day to day, but closed about the same as it had opened. The Bank rate is 7 p.ct., fixed on April 17 last.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 27	4	4%	Aldershot 4 p.c. Pref.	...	56—61	...
1,551,868	,,	Oct. 14	2½	3⅛%	Alliance & Dublin Ord.	59—64	38—43	40—40½
374,000	,,	Jan. 13	4	4%	Do. 4 p.c. Deb.	76—79	47—52*	...
280,000	5	Oct. 28	7½	8%	Bombay, Ltd.	5½—6½	4—4½	4
100,000	5	Aug. 12	16	5%	Bournemouth Gas and Water: 5 p.c.	..	8—9	...
383,110	10	,,	7	7%	Bournemouth Gas and Water: B 7 p.c.	15—15½	8½—9½	...
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	7½—8½	...
162,065	—	Dec. 30	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	...	55—60	55
992,043	Stk.	July 14	14	30/-	Brentford A Consolid.	261—266	50—55	...
734,920	,,	,,	11	26/3	Do. B New	204—209	47—52	51—51½
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	68—73	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb.	91—93	58—60	...
214,775	,,	Aug. 27	11	7½%	Brighton & Hove Orig.	208—213	100—110	...
244,200	,,	,,	8	5½%	Do. A Ord. Stk.	154—159	75—85	...
1,287,500	Stk.	July 29	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Sept. 15	12½	10%	British	44—45	20—22	21½—21¾
120,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	55—57	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	37—40	...
100,000	10	May 27	—	—	Cape Town & Dis., Ltd.	1½—2½	7—7½	...
100,000	10	Dec. 10	—	4½%	Do. 4½ p.c. Pref.	4—6	5—6	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	54—59	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,280	,,	Aug. 12	5/9/4	30/-	Commercial 4 p.c. Stk.	106—108	53—56	...
560,000	,,	,,	5½	26/3	Do. 3½ p.c. do.	103—105	47—52	...
475,000	,,	Dec. 15	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	42—45	...
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	25—30	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	40—50	...
51,600	,,	Aug. 27	14½	10½%	Croydon A 10 p.c.	...	125—135	...
278,400	—	,,	11½	7½%	Croydon B and C 7 p.c.	..	90—100	...
492,270	Stk.	—	6	5%	Derby Con. Stk.	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	5½—6½	5½
16,298,975	Stk.	July 29	4/17/4	30/-	Gas Light and Coke: 4 p.c. Ord.	98—102	56—59	56—58½
2,600,000	,,	,,	3½	26/3	Gas Light and Coke: 3½ p.c. max.	76—79	36—39	37½
4,062,235	,,	,,	4	4%	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	55—58	56½—57½
4,674,850	,,	Dec. 15	3	3%	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	44—47	47
130,000	,,	Dec. 11	10	10%	Gas Light and Coke: 10 p.c. Bonds.	...	...	...
82,500	,,	Sept. 15	5	3½%	Hastings & St. L. 5 p.c.	...	53—58	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	87—89	37—39	...
70,000	10	May 13	11	8%	Hongkong & China, Ltd.	16½—16¾	8½—9½	...
86,600	Stk.	Sept. 15	9	5½%	Hornsey 7 p.c.	...	87—89	...
131,000	,,	Aug. 12	7½	4½%	Ilford A and C	151—154	79—84	...
65,780	,,	,,	6½	3½%	Do. B	115—118	57—62	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	54—56	...
4,940,000	,,	,,	9	4½%	Imperial Continental	150—160	121—126	119—125
1,235,000	,,	Aug. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	90—95	92—92½
235,242	,,	Sept. 15	6½	5%	Lea Bridge Ord. 5 p.c.	119—121	80—85	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. A.	211—213	...	...
					Liverpool 5 p.c. Ord. B.	146—148		
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 12	7/3/6	3½%	Maidstone 5 p.c.	...	52—57	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4¼—4½	1½—2½	...
250,000	100	Oct. 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	86—93	...
541,920	Stk.	Nov. 26	4	6%	Monte Video, Ltd.	11½—12	68—73	...
1,875,892	,,	July 29	4½	3½%	Newcastle & Gatsh'dCon.	98½—99½	60—61	...
529,705	,,	Dec. 30	3½	3½%	Do. 3½ p.c. Deb.	82—85	49—50	...
15,000	10	Sept. 15	—	8%	North Middlesex 10 p.c.	...	12½—13½	..
55,940	10	,,	7/14/0	58%	,, ,, 7 p.c.	14—15	7—7½	...
300,000	Stk.	Nov. 26	8	8%	Oriental, Ltd.	117—122	93—98	...
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	...
60,000	50	Aug. 27	13	7½%	Portsea Island, B	128—131	65—70	...
100,000	50	,,	12	6½%	Do. C	118—121	50—55	...
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	⅞—1	...
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4½—5	⅞—1½	21/—22/-
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	91—93	67—69	...
600,000	Stk.	July 29	4	4%	Do. ,, ,, 1911	...	40—42	...
346,198	,,	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	35—39	...
150,000	10	Sept. 30	6	6/-	San Paulo 6 p.c. Pref.	10½—11	6½—7½	...
125,000	50	Jan. 3	5	5%	San Paulo 5 p.c. Deb.	47—49	37—39	...
135,000	Stk.	Aug. 27	10	5%	Sheffield A	223—224	61—64	...
209,984	,,	,,	10	4%	Do. B	222—224	58—60	...
323,500	,,	,,	10	3½%	Do. C	220—222	55—58	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Sept. 30	9	9%	South African	10½—11½	10½—11½	...
6,609,895	Stk.	Aug. 12	5/4/0	30/-	South Met. Ord.	111—113	63—66	63—65
250,000	,,	Jan. 13	—	5%	Do. Red. Pref.	...	90—92*	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72½—74½	45—48*	...
224,820	,,	Aug. 27	8½	3%	South Shields Con. Stk.	157—159	95—96	...
1,087,795	,,	July 29	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	56—61	58—58½
247,558	,,	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	65—70	..
647,740	,,	Nov. 12	7½	3½%	Southampton Ord.	99—102	55—58	56
121,275	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	...	57—59	...
120,000	,,	Aug. 12	—	3½%	Tottenham A 5 p.c.	135—138	60—65	...
782,275	,,	,,	6	2½%	Tottenham District B 3½ p.c.	115—117	50—55	50½—51½
181,255	,,	Dec. 15	4	4%	Tottenham District 4 p.c. Deb	87—89	55—58	..
182,380	10	Dec. 30	5	5%	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Sept. 15	5	3½%	Tynemouth 5 p.c. max.	108½—109	69—71	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	..	Aug. 27	8½	47/6	Wandsworth A 5 p.c.	151—156	75—80	...
255,636	..	,,	6½	32/6	Do. B 3½ p.c.	129—134	53—58	...
108,075	..	,,	—	33/3	Do. C	...	50—55	...
140,865	..	,,	—	33/3	New Ordinary	...	50—55	...
352,000	..	,,	6½	26/3	Wimbledon 5 p.c.	117—122	43—48	...
98,000	..	,,	6½	32/6	Epsom 5 p.c.	121—126	50—55	...
88,416	,,	Dec. 30	3	3%	3 p.c. Deb. Stk.	66—69	43—45	...

* Ex Div.

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